AVIATION WEEK

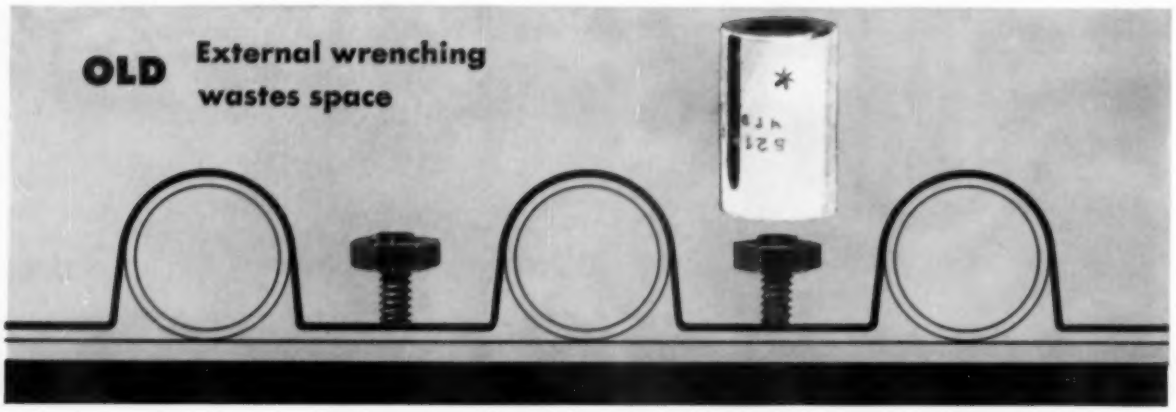
A McGRAW-HILL PUBLICATION

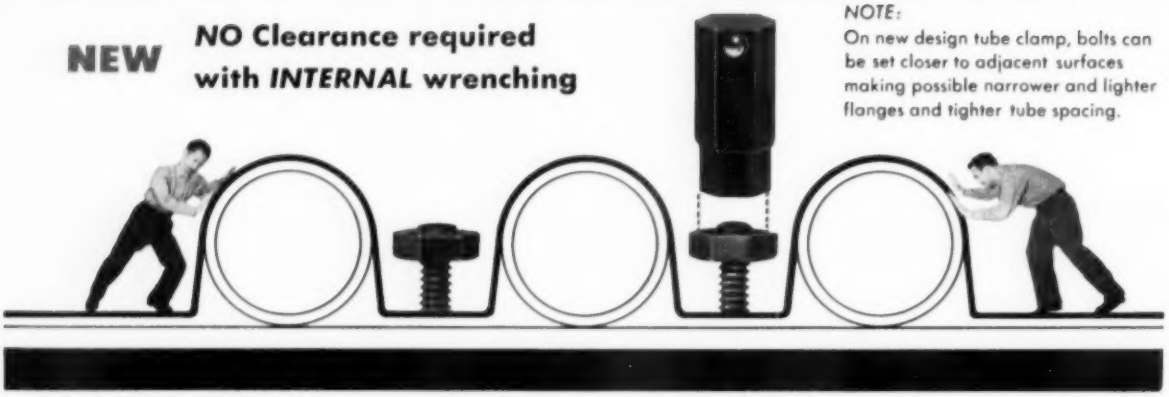
November 11, 1957 75 cents

Designers Study Temperature Effect On B-58 Hydraulics

Piper Comanche

Comanche Stable, Rugged in Evaluation

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NO Clearance required
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NOTE:
On new design tube clamp, bolts can be set closer to adjacent surfaces making possible narrower and lighter flanges and tighter tube spacing.

SQUEEZE

waste space out of your design picture

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All-metal self-locking nuts ®

Internal/external wrenching Hex Nuts

USE OF—Internal/external wrenching Hex Nuts:

- **Strengthens points of potential fatigue failure.**
- **Saves material, space and weight.**
- **Eliminates wrench damage to surrounding material.**

Make use of these weight, space, and cost-saving features by incorporating KAYLOCK internal/external wrenching self-locking Hex Nuts in your designs.

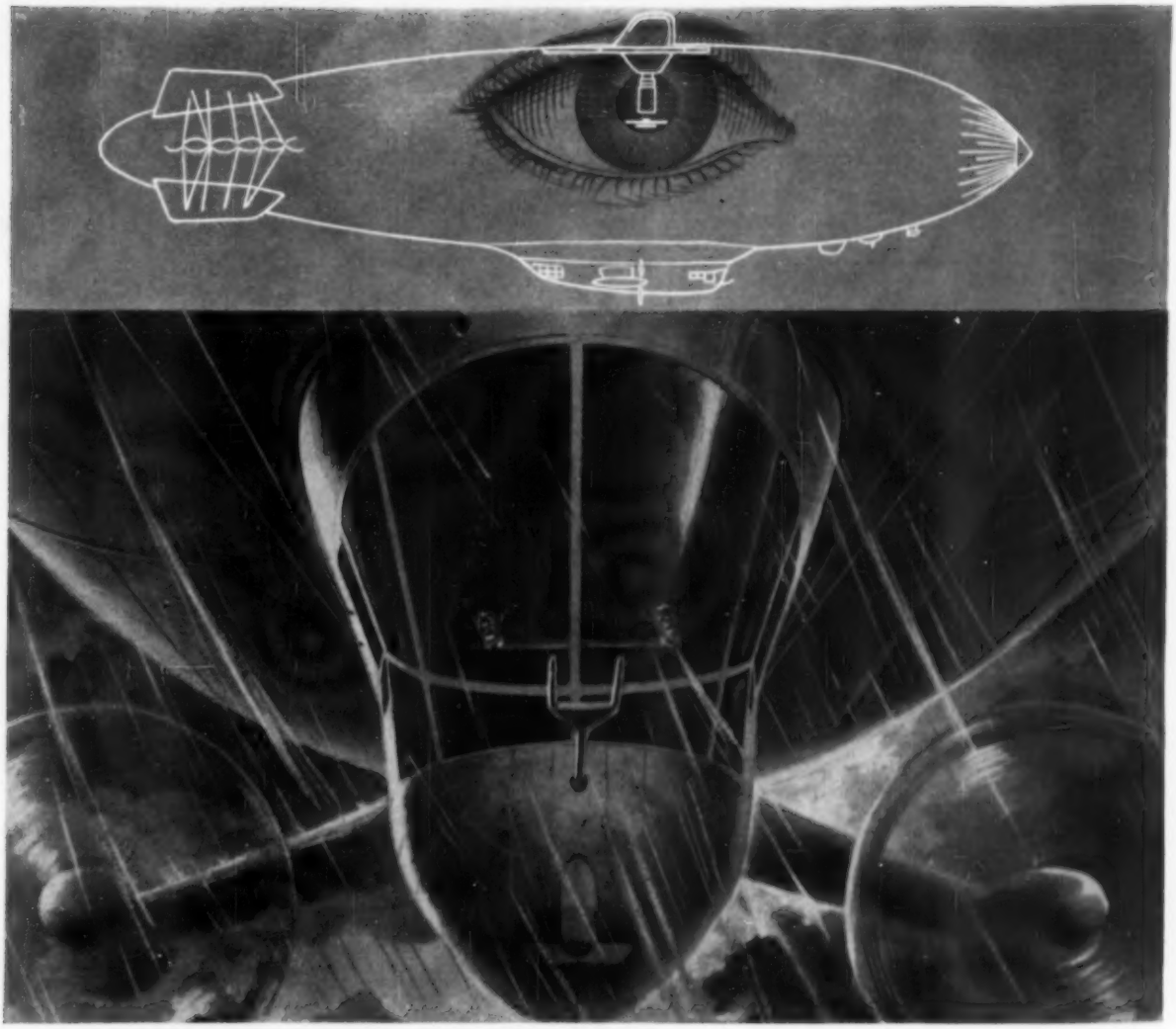
Kaylock Hex Nuts conform to all three Air Force-Navy standards: AN363, AN364, AN365 and the new low height National Aircraft Standard NAS679.

Complete line of Kaylock all-metal self-locking nuts available in steel or corrosion-resistant steel.

Catalog sent on request—

Kaynar Mfg. Co., Inc.—Kaylock Division, Dept. KL, Box 2001, Terminal Annex, Los Angeles 54, California © 1957

Canadian Distributor: Abercorn Aero Ltd., Montreal, Quebec



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Carrying the largest radar antenna ever borne aloft, the airship can guard our sky and sea approaches for days and nights on end—through snow, wind and rain—without relief or refueling.

Only the airship can do it.

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Moreover, *its capacity for riding out the weather with minimum crew fatigue makes the airship unique among aerial sentries.*

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And the airship has other important advantages. It's thrifty with fuel. It's adaptable to a wide range of operating conditions. It provides greater living comfort for the crew.

Most important: *it can do an effective job with fewer units than any other type of airborne early-warning vehicle.*

To the U. S. Navy and the Continental Air Defense Command belongs much of the credit for development of this modified Goodyear ZPG-2W airship. In the years ahead, millions of Americans may sleep better because its crews are alert and on guard.

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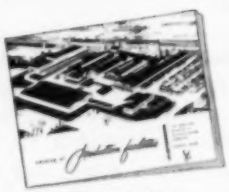

CATALOG OF PRODUCTION FACILITIES
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AVIATION CALENDAR

Nov. 11—Plastics for Airborne Electronics, Regional Technical Conference, Society of Plastics Engineers, Hotel Ambassador, Los Angeles.

Nov. 11-13—Third IRE Instrumentation Conference and Exhibit (Data Handling), Atlanta-Biltmore Hotel, Atlanta, Ga.

Nov. 11-15—1957 International Air Safety Seminar, Flight Safety Foundation, Palo Alto, Calif. FSF-Aviation Week Safety Awards Dinner, Nov. 18. For details write FSF, 468 Fourth Ave., N. Y. C.

Nov. 11-15—National Electrical Manufacturers Association, Annual Convention, Traymore Hotel, Atlantic City, N. J.

Nov. 12-13—Seventh Aircraft Hydraulics Conference, Park Shelton Hotel, Detroit, sponsored by Vickers Inc. (invitation only).

Nov. 13-14—Mid-America Electronics Convention, Municipal Auditorium, Kansas City Mo.

Nov. 13-15—The Society of Technical Writers and Editors, fifth annual convention, Hotel Statler, New York.

Nov. 13-15—18th Annual Convention, National Aviation Trades Assn., Hotel Adolphus, Dallas.

Nov. 14—Meeting on Navarho long-range navigation equipment, professional group on Aeronautical Navigation Equipment, Rm. 1000, Western Union Bldg., 60 Hudson St., N. Y. C.

Nov. 18-21—Air Conditioning & Refrigeration Exposition, International Amphitheatre, Chicago, Ill.

Nov. 18-22—Third Norelco Electron Microscope School, Instruments Division, Phillips Electronics, Inc., 750 S. Fulton Ave., Mt. Vernon, N. Y.

Nov. 18-26—Advisory Group for Aeronautical Research and Development, Combustion and Propulsion Panel, 12th meeting; **Nov. 26-27**—AGARD Aeronautical Panel, Shoreham Hotel, Washington, D. C.

Nov. 18-29—Technical Conference, International Air Transport Assn., Miami, Fla.

(Continued on page 6)

AVIATION WEEK • NOVEMBER 11, 1957

Vol. 67, No. 19

Published weekly with an additional issue in December by McGraw-Hill Publishing Company. James H. McGraw (1860-1948), Founder. Executive, Editorial, Advertising and Subscription offices: **McGraw-Hill Building, 330 West 42nd Street, New York 36, N. Y.** Publication Offices, 99-129 North Broadway, Albany 1, N. Y. Donald C. McGraw, President; Joseph A. Gerardi, Executive Vice President; L. Keith Goodrich, Vice President and Treasurer; John J. Cooke, Secretary; Nelson Bond, Executive Vice President, Publications Division; Ralph B. Smith, Vice President and Editorial Director; Joseph H. Allen, Vice President and Director of Advertising Sales; A. R. Venezian, Vice President and Circulation Coordinator.

Subscriptions are solicited only from persons who have a commercial or professional interest in aviation. Position and company connection must be indicated on subscription order.

Single copies 75¢. Subscription rates—United States and possessions, $7 a year. Canada $8 a year.

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AVIATION CALENDAR

(*Continued from page 5*)

Nov. 20-22—30th Meeting, Aviation Distributors and Manufacturers Assn., Sheraton-Cadillac Hotel, Detroit.

Nov. 25—Board of Directors Meeting, Air Transport Assn., Statler Hotel, Washington, D. C.

Nov. 26—Annual Membership Meeting, Air Transport Assn., Statler Hotel, Washington, D. C.

Nov. 28-30—Annual Snowbird Soaring Contest, Harris Hill, Elmira, N. Y.

Dec. 2-5—American Rocket Society, annual meeting, Hotel Statler, New York.

Dec. 3-4—Human Factors in Systems Engineering, Institute of Radio Engineers & Human Factors Society of America, Penn-Sherwood Hotel, Philadelphia, Pa.

Dec. 4-5—Symposium on high temperature strain gages, Aeronautical Structures Laboratory, Naval Air Materiel Center, Philadelphia 12, Pa.

Dec. 9-13—1957 Eastern Joint Computer Conference and Exhibit, Sheraton Park Hotel, Washington, D. C.

Dec. 16-18—Air Traffic Control Symposium, "The Mission and Methods of the Airways Modernization Board," sponsored by Franklin Institute, Philadelphia, Pa.

Dec. 18—Gas Turbine Development speaker: Rear Adm. S. B. Spangler, USN, Air Development & Materiel Center, at Engineers Club, Philadelphia, Pa.

Jan. 6-8—Fourth National Symposium, Electronics Reliability and Quality Control, Hotel Statler, Washington, D. C.

Jan. 14-15—Yankee Instrument Fair & Symposium, sponsored by Instrument Society of America (Boston, Connecticut Valley and Fairfield County Sections), Hotel Bradford, Boston, Mass.

Jan. 20-Feb. 7—Aviation Institute for Commercial Carriers and Business Pilots, University of Southern California, Los Angeles.

Jan. 29-31—Fourth Annual Meeting, American Astronautical Society, N. Y. C.

Jan. 30-31—American Society for Engineering Education, 1958 College-Industry Conference, University of Michigan, Ann Arbor, Mich.

Jan. 30-31—Seventh Annual Instrument Short Course, sponsored by Southern California Meter Association and Los Angeles Harbor Junior College, at Los Angeles Harbor College, Wilmington, Calif.

Mar. 17-20—Joint Aviation Conference, American Rocket Society-American Society of Mechanical Engineers, Statler-Hilton Hotel, Dallas, Tex.

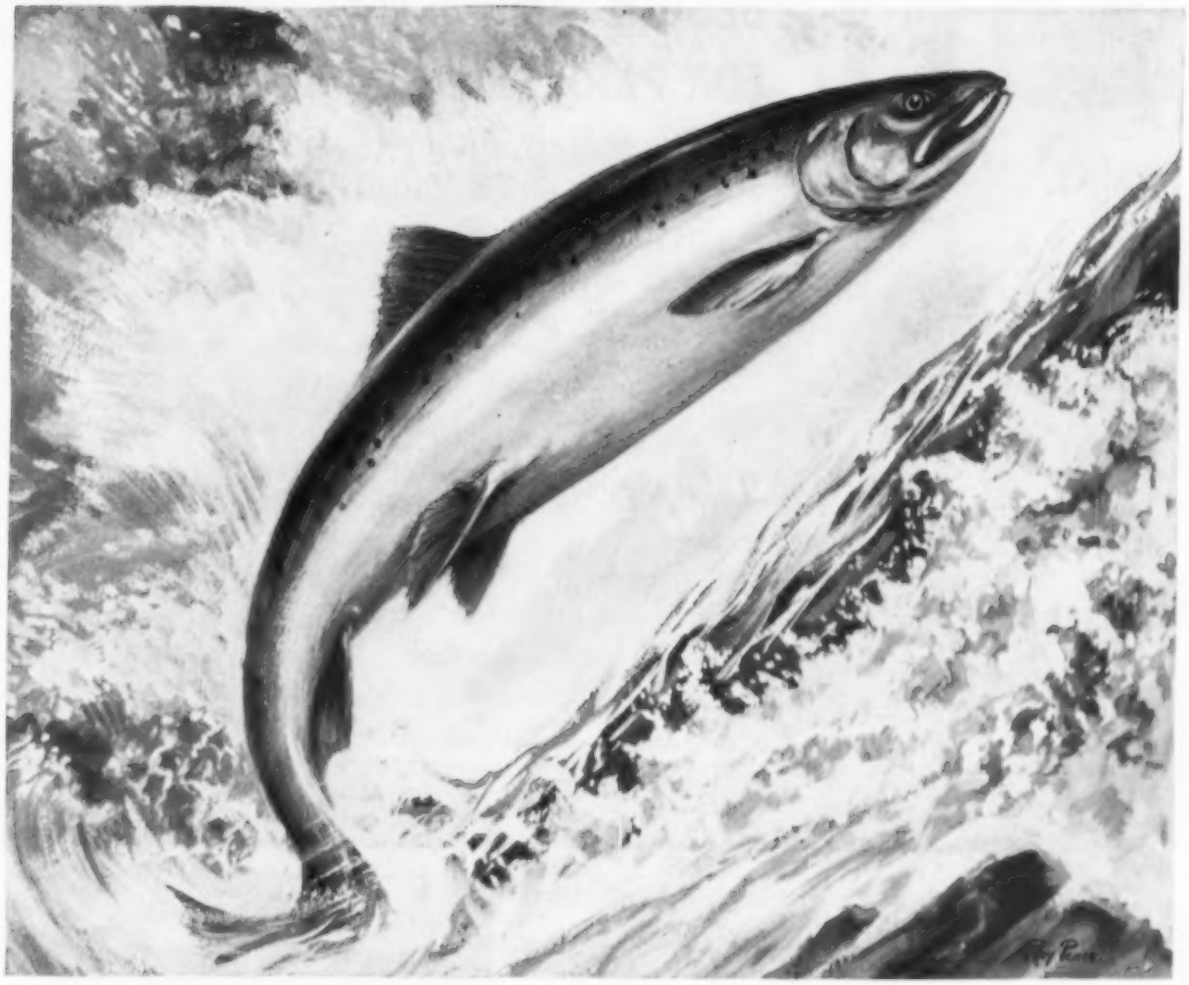
Mar. 17-21—1958 Nuclear Congress, managed by American Institute of Chemical Engineers, 25 W. 45 St., New York 36, N. Y.

Mar. 24-29—Fourth International Instrument Show, Caxton Hall, Westminster, London.

Apr. 17-18—RFC-RNAS Reunion, (World War I), Toronto, Canada. Contact: C. B. Stenning, Chairman, 149 South Drive, Toronto 5.

Apr. 17-18—Institute of Environmental Engineers, Second Annual Technical Meeting, New Yorker Hotel, New York.

Apr. 22-24—1958 Electronic Components Conference; theme: "Reliable Application of Component Parts."



Upstream!

Most people watching a salmon swim upstream wonder how he does it. Seems like a lot of exertion to move from one wet spot to another. To the salmon, though, the compulsive drive upstream cannot be denied.

The titanium industry also has been fighting upstream these past five years. A succession of production rapids and metallurgical waterfalls have been surmounted. The dangerous hydrogen whirlpool was successfully skirted. The industry has now moved through the less white headwaters to fully competitive equality with other structural metals.

Titanium alloys of high strength, light weight and outstanding corrosion resistance are available from T.M.C.A. in all mill forms and in a full range of sizes and gages — sheet, bar, billet, extrusions, tubing and wire. Special heat-treated sheet of very close gage and flatness tolerances is in production for advanced aircraft and missiles.

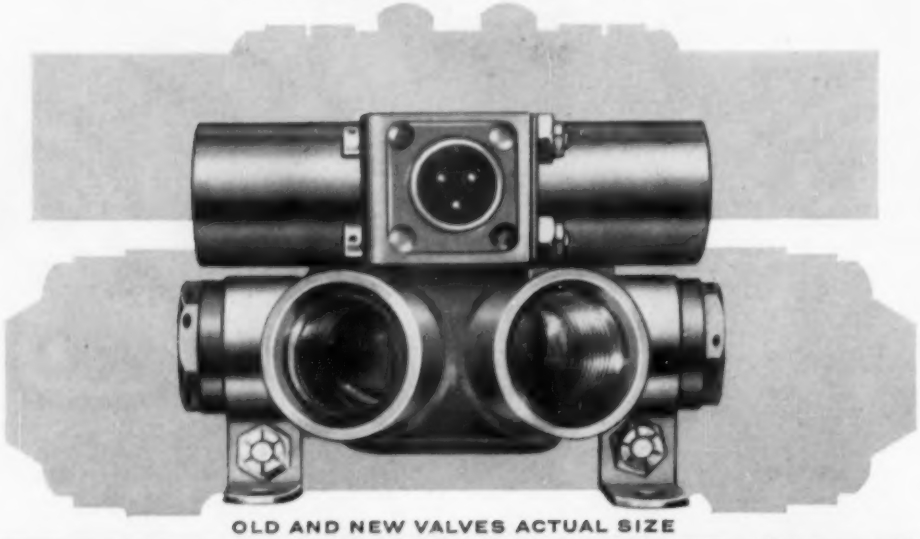
Further expansions of sponge production and metal finishing facilities at T.M.C.A. are bringing titanium within reach of an ever-expanding market. Technical information and specialized engineering services are available for solving those applications having a strength, weight or corrosion challenge.

. . . FIRST IN Titanium

TITANIUM METALS CORPORATION OF AMERICA, 233 Broadway, New York 7, N.Y.

ADEL "DESIGN SIMPLICITY" FOR PERFORMANCE RELIABILITY

New Steel Body, Miniature, Solenoid Operated Directional Control Valves



OLD AND NEW VALVES ACTUAL SIZE

SPECIFICATIONS

Non-Interflow, Low Surge Design Types I & II Sys. (−65°F to +160°F & +275°F) Corrosion Resistant Construction

Operating Pressure Range: 250 to 3000 PSI
Total Pressure Drop: 60 PSI at Rated Flow
Internal Leakage: 10 cc/ Min. Max. at 90°F

Solenoids: Continuous Duty, Single Dry Coil, 18 to 28 V dc operation at −60°F to +275°F
Current Drain: 1 Amp Max. at 28 V dc

Performance and qualification based upon Oil, Specification MIL-O-5606, but suitable for other fluids

Compared with similar valves having aluminum bodies and steel components, these new valves provide: ▶

- 1/5 number of seals
- 1/2 number of parts
- 1/2 space requirements
- 1/2 weight

DESIGNED FOR EXTENSIVE STANDARDIZATION OF PARTS

VARIATIONS

2 and 3 Position, 4 Way
2 and 3 Position, 4 Way with Solenoid Manual Override
3 Position, 4 Way with Piston Manual Override
Line Sizes: ¼, ⅜ and ½ inch Ports per AND 10050

Write today for new descriptive Brochure

Reliability

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ANOTHER FIRST FROM TEMCO

Temco's target drone "Teal" takes to the air to sharpen aim of Navy pilots

The XKDT-1, "Teal," designed and developed by Temco as a low-cost, expendable target system, recently made its initial flight to become the nation's first successful rocket-powered target drone. Carried aloft and launched by an F3H-2M Demon fighter at 20,000 feet, the "Teal" held a straight course for almost eight minutes . . . the first flight of such duration for a drone using solid-propellant fuel. Also, the event was the first successful controlled launching of such a device from swept-wing aircraft.

Capable of operating near the speed of sound at altitudes up to 50,000 feet, the "Teal" will serve as a target for air-to-air missiles and other defensive devices carried by Navy aircraft. It is a Temco development from initial concept to flight readiness, and an outstanding example of Temco's engineering and production capabilities.

The experienced engineer who seeks the challenge of a growing organization, plus the prestige of a soundly established company, will find *his* opportunity at Temco!

In Engineering, The Best Opportunities Are In Aviation

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AIRCRAFT CORPORATION • *Dallas, Texas*

Another Norden-Ketay First in Jet Aircraft Instrumentation

Actual Size

NEW **ONE INCH** JET TACHOMETER INDICATOR

with Integral Aviation Red Snap-in Lighting

A circle only 1" in diameter on the instrument panel — that's all Norden-Ketay's new IT-2 occupies! The ingenious engineering that accomplished such extreme size reduction has packaged a combination of important advantages in this new tachometer indicator design. One of these improvements is the integral aviation-red lighting, which is now provided by three *snap-in* bulbs. Replacement of burn-outs is, literally, a "snap" compared to the older method of detaching leads and soldering in new bulb connections after breaking hermetic seal. The new IT-2 Tachometer Indicator meets Air Force specifications, including MIL-L-25467A. Here is another Norden-Ketay advance that is part of the overall integration of engine instrument display. These new advantages extend the aircraft designer's capabilities in achieving higher standards of performance.

SPECIFICATIONS: *Readout:* %RPM in 0-110% range (100% = 4200 RPM). *Diameter:* 1". *Length:* 5". *Accuracy:* ± 2%. *Operating temperature range:* — 55° to + 70°C. Hermetically sealed. *Lighting:* 5 VDC Mil-L-25467A.

AM-1 Dual Channel Servo Amplifier

IM-1 Airspeed & Mach No. Indicator

IV-1 True Airspeed Indicator

IR-3 Pressure Ratio Indicator

IF-1 Rate of Fuel Flow Totalizer Indicator

TF-1 Rate of Fuel Flow Transmitter

TF-2 Rate of Fuel Flow Transmitter

TF-3 Rate of Fuel Flow Transmitter

IH-1 Hydraulic Pressure Indicator

IT-1 Tachometer Indicator

Norden-Ketay's leadership in the design and manufacture of precision flight instruments stems from the development of the famed Norden Bombsight. Through the years, Norden-Ketay engineering has continued to pace the advancements in reliability, accuracy, size reduction, and now, the integration of human engineering factors into each instrument design.

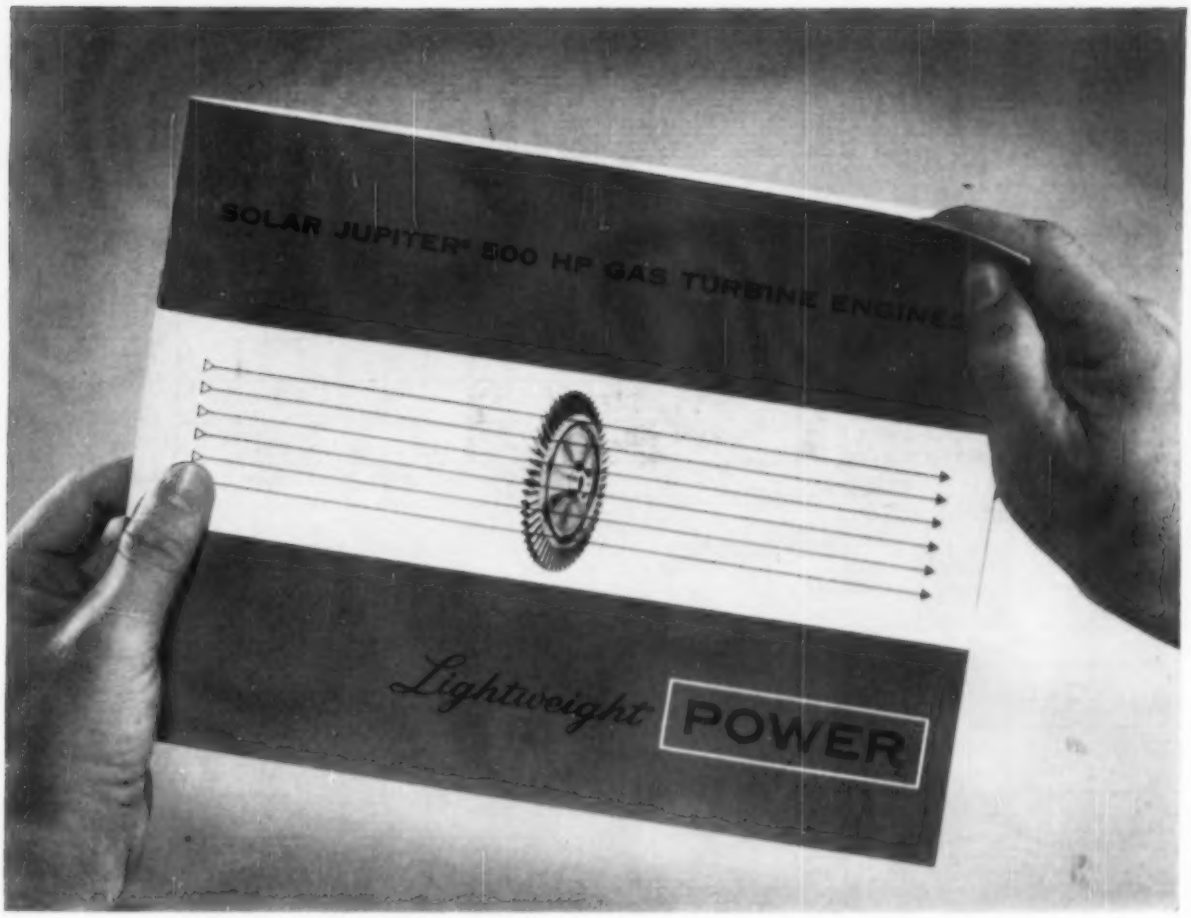
"extending man's capabilities"

N K

NORDEN KETAY

Write for Bulletin 424 containing data on various flight instruments to: Norden-Ketay Corporation, Instrument & Systems Division, Wiley Street, Milford, Conn.

Sales Offices: Stamford, Conn. • Baltimore • Chicago Dayton, Ohio • Denver • Washington, D.C. • Los Angeles



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SOLAR'S 500 HP JUPITER gas turbine offers a radical new power concept for forward-looking businesses. One of the simplest of all heat engines, it provides reliable power for a wide range of military and commercial applications—including boat propulsion, mechanical drive, power generation and others. New users praise its high power-to-weight ratio, its instant starting even under severe temperature extremes, its easy portability and low maintenance requirements.

Solar has prepared a colorful 24-page booklet giving full details about the Jupiter. It contains all of the information necessary to acquaint you with the many advantages of this exciting new engine—and it's yours for the asking. Learn how this power plant of the future can go to work for you—*today!* Solar Aircraft Company, San Diego 12, California. *Designers, developers and manufacturers of gas turbines, expansion joints and aircraft engine, airframe and missile components.*

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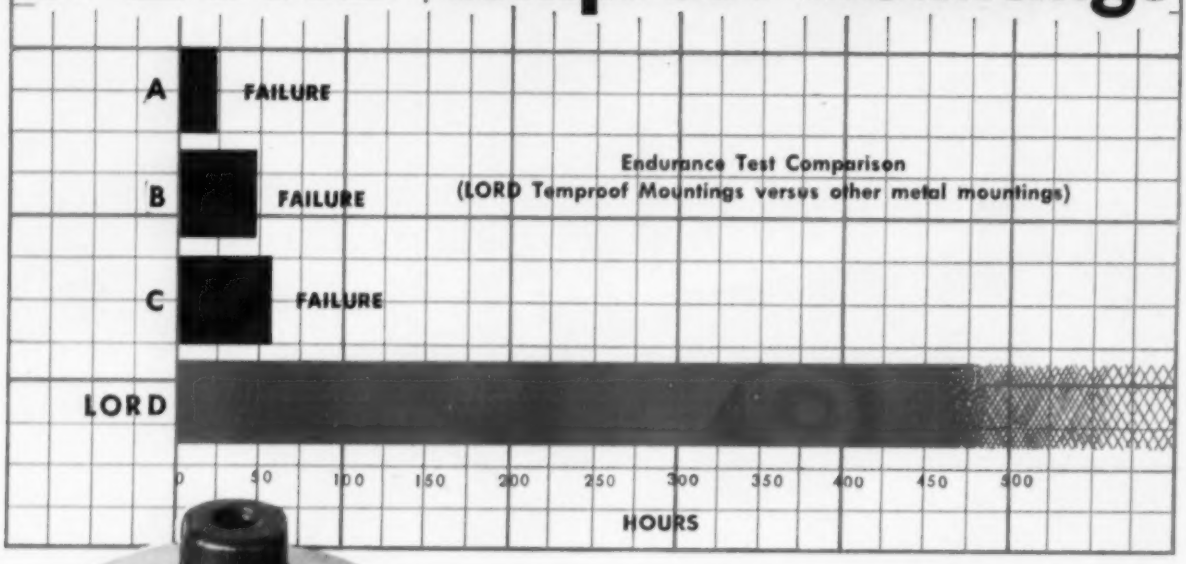
test proves superior endurance of LORD temproof mountings



LORD TEMPROOF MOUNTING

PURPOSE: To compare the endurance of several commercial vibration isolators used in the aircraft and missile electronics field. Test was conducted by an independent laboratory.

TEST CONDITIONS: Three competitive models, in sets of four mountings each, were placed under loads of 16 pounds and vibrated simultaneously at frequencies from 5 cps to 44 cps at a double amplitude of .060".

RESULTS: At the conclusion of the test only the LORD Temproof Mountings had functioned 425 hours and were still in service—with no significant change in vibration characteristics. Mounting "A" failed in less than 20 hours . . . mountings "B" and "C" failed in less than 60 hours.

CONCLUSION: "The LORD Temproof Mounting is more durable than the other vibration isolators tested."

Why handicap fine equipment with vibration isolators that provide less than the best performance? For further information, contact your nearest LORD Field Engineer, or the Home Office, Erie, Pa.

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At aircraft firewalls or in guided missiles... wherever high temperatures are encountered ...you can get full protection by using Cannon Steel Shell High Temperature Connectors to protect electrical circuits.

MS-K receptacle with crimp-type contacts

Cannon Electric supplies both MS-K and FW fireproof types of electrical connectors for the protection of vital circuits in flame barrier applications.

The fireproof test of Military Specification MIL-C-5015 assures that a connector will carry a specified current for 5 minutes and prevent the passage of flame for twenty minutes while being subjected to a flame of 2000°F. Cannon AN-K Connectors meet this specification.

In addition to firewall plugs Cannon Electric has developed connectors that operate continuously up to 1000° F. Developments are under way that will increase the temperature range. We would like to suggest that you will find it well worth your while to consult our engineering personnel for full information on the newest high temperature connectors available.

FW-23 plug, either crimp or solder-pot contacts

For an interesting discussion of the broad subject of "Reliability," write for Cannon Bulletin R-1.

Please refer to Dept. 000

FWR-31SL wall mount receptacle, socket insert

More than 23,000 Cannon Connectors assure you the opportunity of selecting exactly the right connector for any particular application you have in mind. Please write for new 44-page, 2-color Cannon Plug Guide, Bulletin CPG-3.

FWR-22 plug, pin insert assembly

CANNON PLUGS

WHERE RELIABILITY IS THE 5TH DIMENSION

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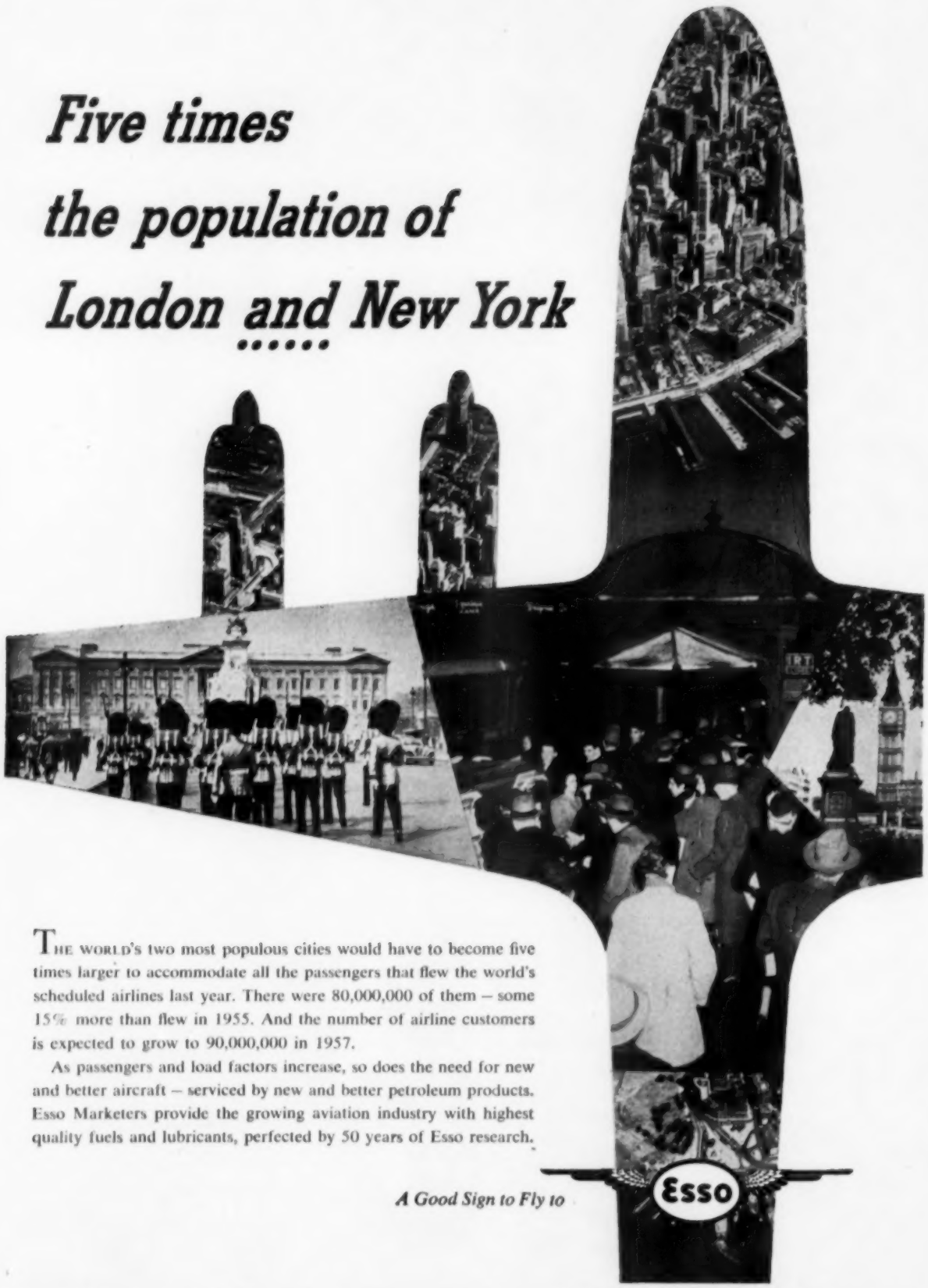
Five times the population of London and New York



THE WORLD'S two most populous cities would have to become five times larger to accommodate all the passengers that flew the world's scheduled airlines last year. There were 80,000,000 of them – some 15% more than flew in 1955. And the number of airline customers is expected to grow to 90,000,000 in 1957.

As passengers and load factors increase, so does the need for new and better aircraft – serviced by new and better petroleum products. Esso Marketers provide the growing aviation industry with highest quality fuels and lubricants, perfected by 50 years of Esso research.

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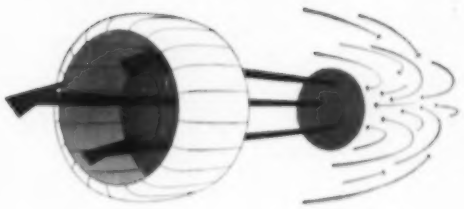
8 OUT OF 10 OF ALL THE WORLD'S INTERNATIONAL AIRLINES USE ESSO AVIATION PRODUCTS

CAPABILITY



With us, capability is the sum total of many factors: an applied combination of our modern industrial installations, highly skilled manpower, and tightly knit organizational spirit!

That spirit is an intangible. It can't be measured specifically like our man or machine power – but it's that asset that helps spearhead our –

. . . *capability* to wage an "all-out" assault on difficult production design problems.

. . . *capability* for constant research and development of new methods of manufacturing products faster, better and more economically.

. . . *capability* to meet rigid specifications and exacting delivery schedules.

. . . *capability* for devoting and channeling *all* our experience to a project – no matter what the size.

. . . *capability* of quality volume at the lowest possible cost.

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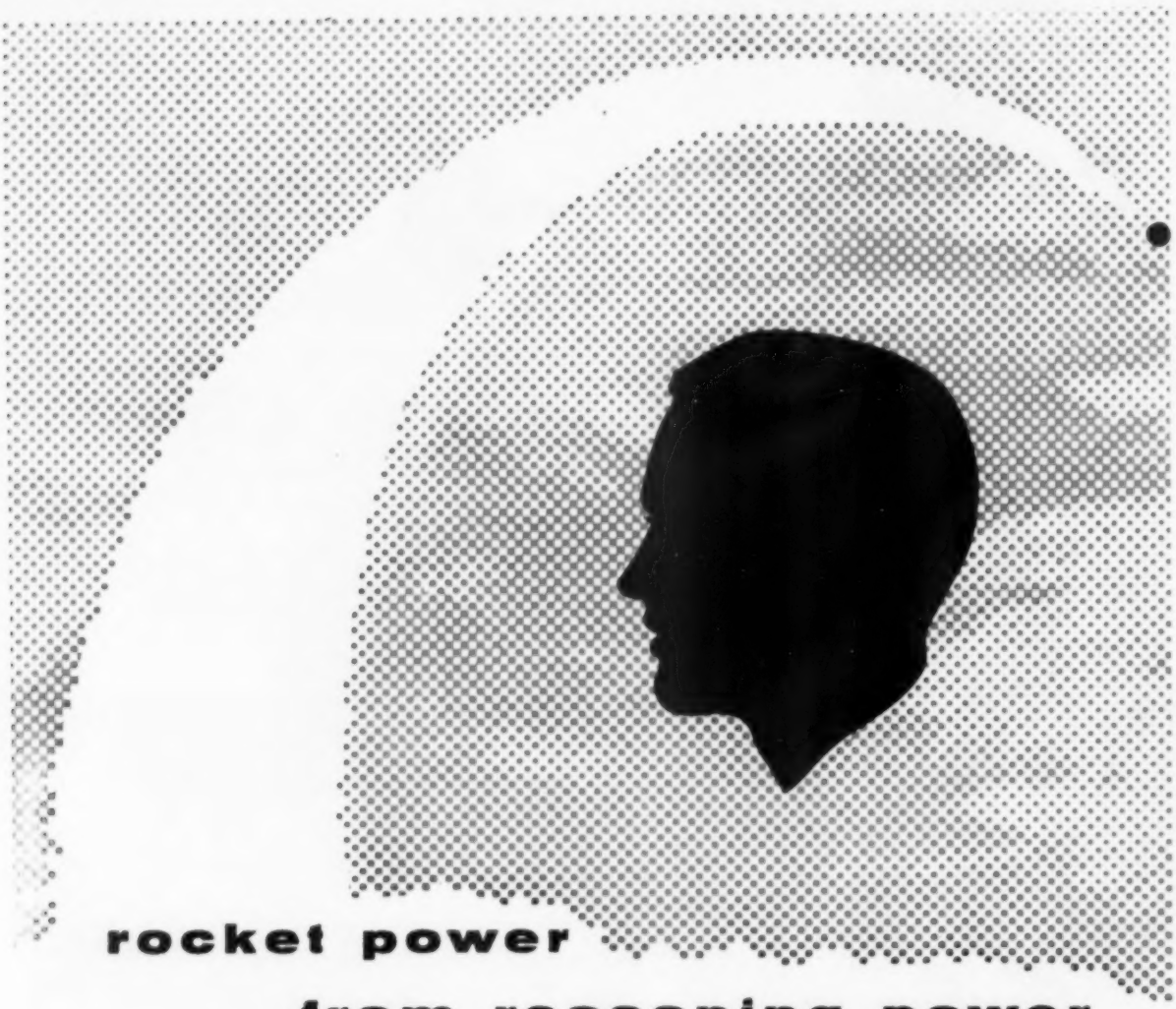

rocket power from reasoning power

A *reasoning* mind—man has always found this his most useful weapon when venturing into unknown fields. Today's frontier—one of the greatest unknowns ever faced by man—lies in outer space.

RMI, America's *first* rocket family, is uniquely qualified to help our country conquer the new frontier. For this project will require more powerful and more efficient rocket propulsion systems than any yet designed. And RMI's experience in the rocket power field extends back over 15 years . . . years in which RMI scientists and engineers pooled their reasoning power and knowledge to develop entirely new methods of propulsion and to produce rocket powerplants for dozens of military vehicles.

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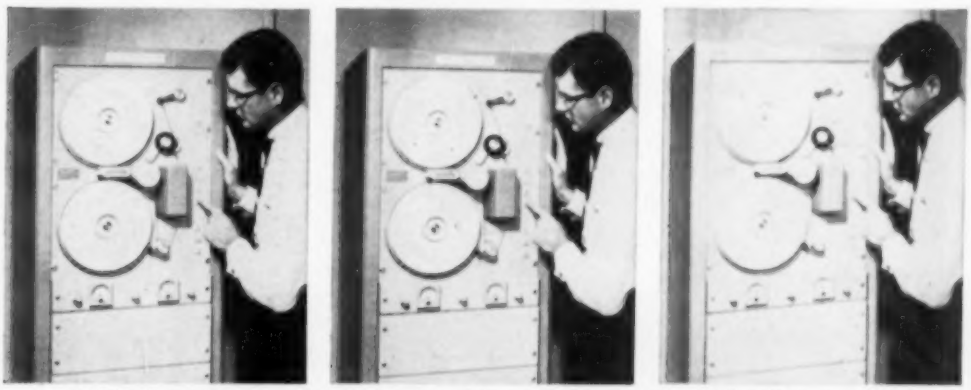
How the Queen's picture kept its charm

Introducing "FAXTAPE"— facsimile on magnetic tape

We were entirely in accord with the British and Canadian points of view. Her Majesty's visit to Canada deserved special effort...which meant, from us an earlier-than-planned unveiling of magnetic-tape facsimile recording.

To disseminate phone-line news photos of the occasion, Ampex delivered FAXTAPE number one to Canadian Overseas Telecommunication Corporation's Vancouver office. By recording pictures off the wire onto tape, C.O.T.C. was prepared for retransmitting to overseas with no visible loss of quality – desirable for any subject – even more so for the Queen.



FAXTAPE records its own photograph and provides a revealing comparison. Left photo was printed directly off the facsimile wire. Center is the photo after being received on tape and retransmitted. Right is the same photograph after being retransmitted the conventional way off a facsimile print.

A SLOW-SCAN COUSIN OF VIDEOTAPE

Ampex's FAXTAPE is to facsimile as Videotape is to television. It records the electrical signals used in picture transmission. Tape playback reproduces identical voltage patterns, retransmitting the picture and/or feeding a transceiver to make a negative or print.

FAXTAPE is a versatile adaptation of an Ampex FR-1100 instrumentation tape recorder. FM-carrier electronics provide faithful amplitude reproduction for accurate grey-scale with a tape speed of 7½ in/sec. matching phone-line frequency response of 2500 cycles/sec. A real technical achievement in the system is a tough, reliable time standard so precise that the drift is only one second per week. This keeps picture skew down to imperceptible levels.

PICTURE TRICKS AND PRACTICAL ANSWERS

For news photos, weather maps, documents and military data, picture quality no longer demands simultaneous transmission to all receiving points. From tape a second-generation facsimile is as good as the original. Even a third or fourth tape generation is entirely acceptable.

For unattended receiving, FAXTAPE provides one whole hour of recording time per reel. Unlike a facsimile transceiver, magnetic tape does not require makeready on each picture – and incidentally eliminates chance of wrong scanning speed or photo development errors. Voice instructions, coding and scale are recorded on the tape together with the picture itself.

Lines and radio links can be used more effectively and economically with FAXTAPE. Facsimile can be collected on tape and held for available line time or clear broadcast conditions. Also, when wider frequency bands are available, the tape can be speeded up many fold reducing transmission time accordingly.

Tricks? FAXTAPE plays back an electronic picture. You can stretch it, shrink it, speed it up, slow it down, invert the grey scale, juggle the values, or feed it all to a computer – subject only to the limits of human ingenuity. Any ideas?

Can we send you a brochure? answer questions on a specific application? or mail more of this informative ad series direct? For any of these requests, please write Dept. UU-9.

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HIGH ALTITUDE PHOTO ABOVE EGLIN AIR FORCE BASE

FIREBEE: "ENEMY" JET OVER AMERICA

The most realistic "enemy" in the skies over America today is the Ryan Firebee. This jet-fast, elusive target drone is being used to sharpen the sights of the men who man the nation's air defense system and to evaluate the missiles upon which they rely.

The Firebee flies at the high speeds and altitudes required to test the performance of the newest, most deadly air-to-air and ground-to-air missiles. It possesses the maneuverability and extended duration needed to realistically simulate "enemy" intercept problems.

Developed by Ryan for the Air Force (Q-2A), Navy (KDA-1) and Army (XM21), the Firebee is in volume production and operational use. It is being fitted with special radar and infra-red reflective devices for simulating varied target characteristics and providing broader missile-target compatability. The Firebee can be equipped with wing pods to carry added fuel... a warhead... photo or television reconnaissance gear.

The Firebee is an example of Ryan's skill in blending advanced aerodynamic, jet propulsion and electronics knowledge to produce a highly successful solution to a complex aviation problem... meet a vital military need. Other examples are the Air Force-Ryan X-13 Vertijet and Navy-Ryan AN/APN-67 automatic navigator for global jet flight.

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November 11, 1957

AVIATION WEEK

Vol. 67, No. 19

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Ballistic Missile Has Glide Potential 26
▶ Doubled range for IRBM, ICBM evasion capability are possibilities drawn from data in NACA reports.

Airline Earnings Point Toward New Low 38
▶ Industry profits show sharp dip in third quarter; earnings for 1957 may fall below $50 million.

Comanche Shows Stability, Ruggedness 100
▶ Aviation Week check flight reveals four-place, single-engine plane has some easy-to-fly characteristics as its Piper forebears.

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EDITORIAL

Newspapers Discuss Secrecy Issue... 21

COVER: Piper Aircraft Co.'s new single-engine, all-metal, four-place PA-24 Comanche is in a price class ($14,500, standard model) between the company's Tri-Pacer and its twin-engine Apache. Airplane features laminar-flow wing section, horizontal stabilator and is powered by a Lycoming O-136-A1A 180 hp. engine driving constant-speed, controllable propeller. Comanche has cruising speed of 160 mph. TAS at 75% power at 8,000 ft.; economy cruising range is 1,100 mi. (For detailed Aviation Week flight evaluation of Comanche, see page 100.)

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AVIATION WEEK • November 11, 1957 • Vol. 67, No. 19

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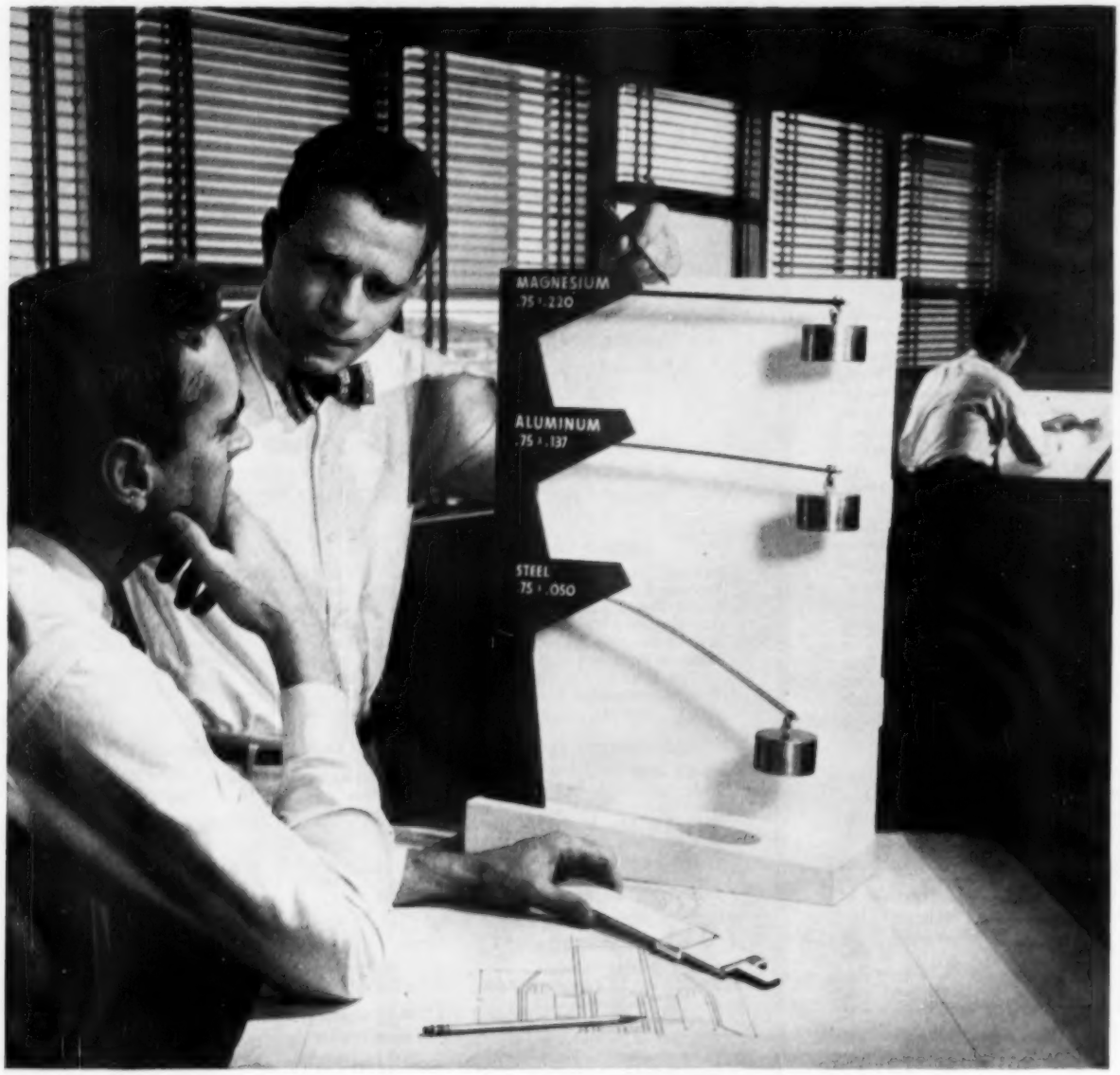

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Magnesium's unique combination of strength and light weight gives it some outstanding abilities as a structural metal. Take rigidity, for example. A magnesium bar has 22% the stiffness of a steel bar of the same dimensions.

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YOU CAN DEPEND ON DOW

EDITORIAL

Newspapers Discuss Secrecy Issue

Following are daily newspaper editorial comments on the issue of government secrecy raised by the "off-the-record," behind-closed-doors remarks about Aviation Week by Robert Cutler, Special Assistant to the President for National Security Affairs, and Loyd Wright, who headed the Commission on Government Security (AW Nov. 4, p. 28):

Unfair

Washington Post and Times Herald

It is a good thing that the House Government Information Subcommittee is going to investigate the reported assault made on the good name of Aviation Week magazine because it disclosed that the United States had been able to track Soviet missiles.

No investigation would have been necessary, however, if Robert Cutler, President Eisenhower's Special Assistant for National Security Affairs, had made any charges that he had to make on the record. There is something about secret assaults upon the conduct of another that is repugnant to those who believe in ordinary standards of honorable behavior. Where such accusations are required, let them be made openly. It is particularly deplorable when persons enjoying the amplitude of governmental power set afoot canards of this kind against those with whom they disagree. Such tactics cloud the charge itself in inaccuracy and deprive the objects of it of an opportunity to make an answer.

Mr. Cutler is well known as an advocate of the most extreme kind of secrecy about government operations. Whether the national interest has suffered more from the public ignorance he has fostered or from the disclosures by publications he dislikes might make a good topic for debate. The merits of that dispute aside, the only honorable course for Mr. Cutler now is to put upon the record his secret and private assault upon the good name of the officers of a publication who have as much right as Mr. Cutler to cherish their reputation for loyalty and patriotism.

Careless Use of Nasty Word

The Milwaukee Journal

The magazine Aviation Week reports that American radar equipment in Turkey helps keep tab on Soviet Russian missile firings.

Loyd Wright, who headed a presidential commission on government security, almost blows up over the disclosure. He sees it as "assisting the enemy." He renews his plea for a law he wants to send newsmen to prison for disclosing government secrets.

Robert Cutler, President Eisenhower's assistant on national security matters, almost follows the Sputnik into space in exasperation. He calls the report "shameful." Many who heard him speak before some of the nation's biggest industrialists and defense producers the other day say that he called it "treason."

Why the blowup? Because, apparently, the American people were told a "secret." It's a secret everyone else knew, of course. The Russians knew it. The Turks knew it. But the American people didn't know it—even though it's their radar. And telling them becomes "treason." Apparently a person who gives a spoonful of truth to the American people and threatens to disturb their peaceful slumbers under the rock-a-bye-baby treatment of the Administration is a traitor.

This is pretty careless use of a nasty word like "treason." If it can be applied to those who merely say something the Administration would prefer not be said, what strong enough words can be found to apply to some of the goings-on in Washington?

What word is strong enough to label our obvious defense bungling? What word to describe the refusal of our leaders to tell our people truths that have long been apparent to everyone else in the world? What word to brand the strup under which Administration spokesmen—sometimes including the President—try to cover up some of the hard facts of the world?

Truth, the theory seems to be, is a fine thing for everyone but Americans. Daddy, in the form of the Administration, will decide what Americans can hear and what they should believe—and the pap will be sweetened with homilies from Abilene and righteousness from Duck Island.

There will be sad days if Americans stand still very long for this sort of thing.

Washington Calling

By Marquis Childs

St. Louis Post-Dispatch Syndicate

. . . What Washington lacks above all, is a positive rather than a negative news agency. When Aviation Week magazine broke the story of American radar bases in Turkey, there was indignation in the Administration, the reaction being that even though the Russians knew this, they could now go to the Turks with an official complaint.

The defense in psychological warfare is always under a grave handicap. It is not too late to accent the positive, but time is slipping by.

. . . Fears Public Disclosure

The Hartford Courant

Special Presidential Assistant Robert Cutler deserves a swift rebuke from his superior. Mr. Cutler, on leave from a Boston banking post, handles a key role in the nation's security affairs. His reaction, however, to a recent magazine article that told the American people something they had a right to know suggests that Mr. Cutler may have outlived his usefulness. He is, after all, a servant of the people even if he is installed by special appointment and protected by a cultivated anonymity.

Mr. Cutler, reports have it, objected violently to the disclosure by Aviation Week that the United States had a long-range radar set in Turkey monitoring Soviet missile tests. The magazine discussed its reasons fully in making the news public. It pointed out that the Russians were fully aware of the set, and that the only ones in the dark were the American people. Most of all, they were unaware that the Administration had much more information on Russian missile progress than it had allowed to be printed, thus

(*Continued on p. 36*)

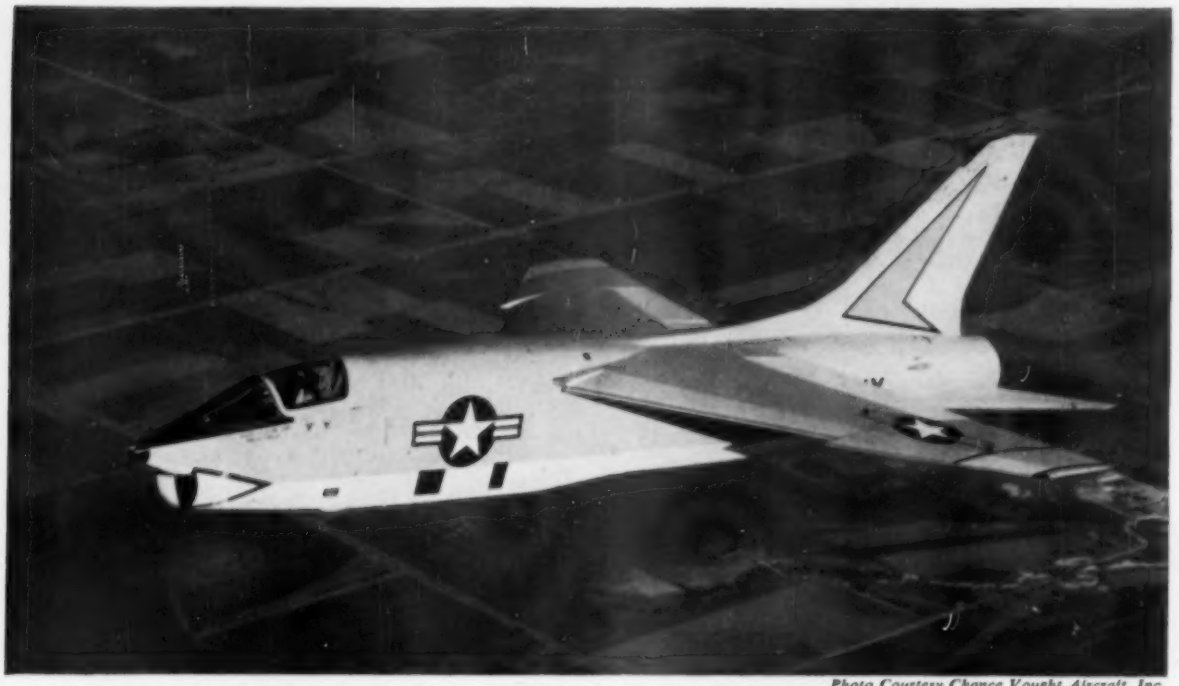


Photo Courtesy Chance Vought Aircraft, Inc.

F8U-1 Crusader which flew Los Angeles to New York in 3 hours 23 minutes, photographing country coast to coast.

CHR seals assure top aerodynamic efficiency of F8U-1

Dacron covered silicone rubber airframe seals provide low friction, abrasion resistant surface, — 100°F to 350°F flexibility.

Gaps between moving and stationary parts of an airfoil section create drag that can seriously reduce aerodynamic efficiency. Sealing these gaps . . . aerodynamic sealing . . . is an economical means of assuring clean aerodynamic lines. Sealing these gaps also compensates for variations due to flight stresses and production tolerances.

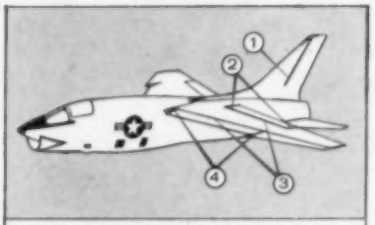
Aerodynamic sealing is used extensively in Chance Vought's F8U-1. To assure optimum aerodynamic efficiency Chance Vought seals the gaps at the droops, flaps and ailerons, as well as those at the rudder. CHR produces these seals for Chance Vought and assisted in their design, specifically with material recommendations.

The F8U-1 aerodynamic seals are made of silicone rubber covered with Dacron fabric. They are flexible at extreme low temperatures, are abrasion resistant and provide a low friction surface. Cross-sections of these seals are illustrated and described at right.

CHR specializes in the production of airframe seals. Developing techniques to combine silicone rubber with such materials as Teflon, stainless steel, aluminum, Dacron and glass fabrics and fiberglass-polyester laminate, CHR has greatly increased the application range of the rubber. Examples of airframe seals currently in production at CHR include:

Silicone rubber inflatable canopy seals • Teflon covered silicone rubber aerobalance seals • Fuel resistant fabric reinforced fluoro-silicone rubber seals for powerpack hatches • Teflon and fabric covered silicone rubber aerodynamic seals • Molded silicone rubber window seals • Extruded and spliced silicone rubber hatch seals • Integrally molded fabric reinforced silicone rubber inspection station seals • Firewall seals • Wheel well bumper pads.

Our experience in helping engineers with all types of airframe and engine seals for −100°F to 600°F applications utilizing all forms of silicone rubber can be put to work for you. For design assistance and production requirements, write or phone CHR. Field representatives are available for direct contact.



1. **Fin to rudder seals** — Dacron covered silicone rubber with spring steel inserts.
2. **Inboard-outboard aileron seal** — Dacron covered silicone rubber.
3. **Wing to droop and wing to flap seals** — Dacron covered sponge rubber, one bonded to spring steel.
4. **Inboard-outboard droop seal** — Dacron covered silicone rubber and silicone sponge rubber.

Available on request to airframe and engine company engineers: *Airframe Seal Design Charts:* 8 pages: load-deflection charts for basic seal shapes and material combinations. Write for copy.

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Elbert G. Bellows, a vice president, The W. L. Maxson Corp., New York, N. Y.

Robert W. Olson, vice president-research and engineering, Texas Instruments, Inc, Dallas, Tex. **E. O. Vetter** succeeds Mr. Olson as general manager of the Industrial Instrumentation Division (Houston).

F. O. Robison, vice president, California Technical Industries, division of Textron, Inc., Belmont, Calif.

Reese Lloyd, vice president, Kelsey-Hayes Co., Detroit, Mich.

Sam Norris, Assistant Director, Electronics Division, Business and Defense Services Administration, U. S. Department of Commerce, Washington, D. C. Mr. Norris, president and board chairman of Nuclear Corporation of America, Inc., New York City, is on loan to BDSA.

Col. Charles B. Brown (USA, ret.), administrative assistant to the president, ESC Corp., Palisades Park, N. J.

Charles H. Startup, assistant vice president-customer service, American Airlines, Inc.

Honors and Elections

Frank Pace, Jr., president of General Dynamics Corp., has been elected a board member of the National Industrial Conference Board, New York City.

Paul D. Frost, chief of Battelle Memorial Institute's Light Metals Division, has been awarded the 1957 Metal Treating Institute Achievement Award for his article concerning heat treatment of titanium.

Changes

George F. Rice, chief engineer, The Garret Corporation's AiResearch Aviation Service Co., Los Angeles, Calif.

James P. Brown, manager-West Coast operations Grand Rapids (Mich.) Division, Lear, Inc., Santa Monica, Calif. Also: **John E. McKeighan,** contracts manager, Lear-Romec Division, Elyria, Ohio.

Robert M. Fritz, manager-marketing, Missile and Ordnance Systems Department, General Electric Co., Philadelphia, Pa.

Brig. Gen. William L. Bayer (USA, ret.), manager-military marketing, Electronics Division, Stromberg-Carlson, division of General Dynamics Corp., Rochester, N. Y.

Mathias Klein, director of manufacturing, Marquardt Aircraft Co., Ogden, Utah. **Robert D. Harris** succeeds Mr. Klein as factory manager.

Lloyd R. Everingham, technical advisor for systems research, Radiation, Inc., Melbourne, Fla.

Maurice C. Hanafin, manager, Schockley Semiconductor Laboratory of Beckman Instruments, Inc., Los Angeles, Calif.

INDUSTRY OBSERVER

► Use of ionization trails left by supersonic aircraft and missiles as low frequency antennas is being studied by Federal Telecommunication Laboratories under Naval Research Laboratory contract. Technique utilizes high electrical conductivity of these ionized paths. Problem of coupling to the trail is said to have been solved, but frequency range is not known. Present aircraft antennas decrease rapidly in efficiency below 100 mc.

► North American Aviation Inc. has gone to capsule configuration for high performance aircraft escapes. Philosophy is carried out in F-108 long-range interceptor and WS-110A chemical bomber designs. Capsule resembles Goodyear configuration but is entirely a North American design.

► Range of 3,000 mi. given for Columbia University's Omnirange Digital Radar (Ordir) against an intercontinental ballistic missile by USAF officials (AW Sept. 30, p. 25) may be an optimum-conditions figure with effective range closer to 2,000 mi. Field evaluation of Ordir principle on General Electric FPS-17 missile detection radars in Texas and Turkey is expected to provide detailed data on effective range under varying conditions and targets.

► Mother plane for North American X-15 high-altitude research vehicle will be a Boeing B-52. Indications are that pilot will be sealed into X-15, make entire trip inside his own machine rather than have entrance, egress in air.

► Farside research vehicles recently fired at Eniwetok had stability spin of five feet per second imparted by first stage cluster of four Thiokol Recruit rockets.

► Allegany Ballistic Laboratory has developed a solid-propellant rocket with an overall specific impulse of 285 seconds, about 40% better than most types.

► North American Aviation has submitted plan for production-type brazing facility for stainless steel sandwich in conjunction with its proposal for the WS-110A chemical bomber. Sandwich plays major role in design makeup of WS-110.

► McDonnell flying crane studies show that four of the aircraft with 1.5-ton capacity can be carried inside a Lockheed C-130 without disassembly. Larger 10-ton payload flying crane could be carried in a C-130 by being taken apart for loading.

► At least two of five G26s (XSM-64) which North American Aviation was authorized to launch after USAF cancellation of the Navaho SM-64 project have achieved a range of about 500 mi. against a goal of approximately 1,200-1,500 mi. G28 (SM-64A), final Navaho version which has never flown, was to have been fitted with a three-barrel booster developing 405,000 lb. thrust from alcohol-Lox.

► Despite Vanguard lag behind Russian satellite launchings, project employes still feel technical successes thus far are impressive. Vanguard rocket system is one of the most sophisticated yet. Guidance tested in Test Vehicle O, spin table and third stage Grand Central Rocket engine tested in TV-1 and General Electric first-stage engine tested in recent TV-2 firing all had high degree of success, although they were first-time attempts. TV-2 firing is believed to be the first time a U. S. first-stage missile engine ever was so successful on its initial flight.

► North American's now-canceled Navaho intercontinental missile project made many major contributions to state of the art. Among them: major design contributions in the conceptual phases of long-range missiles, development of extremely accurate gyros; design, development and construction of high-thrust rocket engines and booster packages. Program also helped solve many of the vexing problems of bringing along a complete high supersonic ramjet system, which was developed in conjunction with Curtiss-Wright.

FOR EXTREME TEMPERATURES . . .

New, lightweight Westinghouse aircraft transformer withstands severe vibration, shock, humidity

This new Westinghouse aircraft current transformer performs accurately under the most extreme operating conditions — even in ambient temperatures from —55°C to 170°C.

Molded from a new high temperature insulating resin, this new transformer is smaller, lighter — actually weighs less than thirteen ounces, has a height and width of only 3¼ inches.

The new unit has a 250/2-ampere current ratio and operates on 115-volt, three-phase, 400-cycle systems. It fulfills the requirements of specification MIL-T-7210 for Type D-2 current transformers.

For further information about this outstanding aircraft transformer, call your Westinghouse representative . . . or write: Specialty Transformer Department, Westinghouse Electric Corporation, P.O. Box 231, Greenville, Pennsylvania.

J-70821

YOU CAN BE SURE... IF IT'S Westinghouse

Washington Roundup

F-101 Record Try

Watch for the McDonnell F-101 Voodoo twin-jet fighter to try to set a new world speed record over a measured course. Attempt will be made at Edwards AFB, Calif., late this month and is slated to give the Voodoo the coveted Thompson Trophy, long the top prize for closed course racing in the old National Air Races. In more recent years, the award has gone to jets for records set at the Edwards test center. Present holder is Navy's F8U Crusader, built by Chance Vought, which captured the Thompson Trophy in 1956 with a speed of 1,015.428 mph. Voodoo will seek to topple this mark as well as the world speed record of 1,132 mph. set earlier last year by the British Fairey Delta FD2 research aircraft. Lockheed F-104 also could upset both marks, but Defense Department has given permission only for the F-101 to make the attempt.

Too Many 'Yes' Men

Dr. Fritz Zwicky, one of the best minds in U.S. basic research, blames America's lag in the missile race to an overabundance of "Yes" and "No" men. These are the three reasons, he says, why Russia launched the first successful satellite:

- **"We have too many 'Yes Men'** supporting mediocre or downright worthless scientific projects.
- **"We have too many 'No Men'** obstructing or impeding advanced projects.
- **"We have too many people** who don't care."

'Sputnik Jitters?'

Following in Sputnik II's wake last week came a flurry of new "flying saucer" sightings, with reports ranging from White Sands, N. M., to the Fiji Islands and South Africa. Pentagon officials generally attributed the sightings to a bad case of "Sputnik jitters." Others were not so sure:

An electronics engineer at USAF's Missile Development Center, Holloman AFB, N. M., reported that an unidentified object 'killed the radio and engine of his automobile as it approached over the Sacramento mountains.

U.S. Coast Guard cutter Sebago reported spotting a "brilliant" flying object in the sky at a point 200 mi. south of the mouth of the Mississippi River. Officers said radar contact with the object was retained intermittently for 30 sec., visual contact for three sec.

Air Force, despite its belief that Sputnik was responsible for it all, alerted its radar network to watch for anything unusual and ordered an investigation of the reports.

'Unidentified Object' Study

As the "saucer" reports rolled in, Air Force released results of a 10-year study on reports of unidentified flying objects. Air Force, which had planned to release the report before the latest outcrop of sightings, said it had found no evidence "to confirm the existence of so-called 'Flying Saucers.'"

From the time of the first "flying saucer" report on June 27, 1947, USAF says it has investigated 5,700 sightings. Of these, it says, it has tracked down the origin of all but approximately 2%. "Flying saucers" that later turned out to be a little more worldly were said by USAF to include sightings of modern aircraft under certain weather conditions, balloons, meteors, clouds, blimps and Canadian geese.

Why a 'Czar?'

Suggestions from Capitol Hill that a new top executive post be created to unravel the missile and satellite mess are bringing a number of caustic comments from informed Pentagon circles. Talk about a "czar" with new and mightier power raises the suspicion among veterans that the idea would result in nothing but more delays and make it even tougher to get decisions. Both Eger V. Murphree and William M. Holaday have held title as Assistant to the Secretary of Defense for Guided Missiles.

"What," ask the veterans, "will a new czar do that Murphree and Holaday can't do? For that matter, what contribution in our effort to achieve operational capability has been made by either Murphree or Holaday?" So far, Pentagon corridors, 22 mi. of them, have produced no answer.

Defense Declines

Defense Department refused to send a representative to a Civil Aeronautics Board meeting called last week to discuss problems involved in the Board's proposal to delegate authority to the Civil Aeronautics Administrator for the allocation of military and civil airspace (AW Nov. 4, p. 37). Defense Department has vigorously attacked the plan; its failure to participate in the meeting is viewed by other operators as meaning that it intends to stand firm in its protests. The proposal, which would transfer airspace assignment authority from the Air Coordinating Committee to the CAA, is supported by civil users. However, delegates to the meeting called for strong provisions in the proposed rule-making that would prevent the CAA from succumbing to military pressures in allocating restricted airspace areas which, they charged, has been the case in the past.

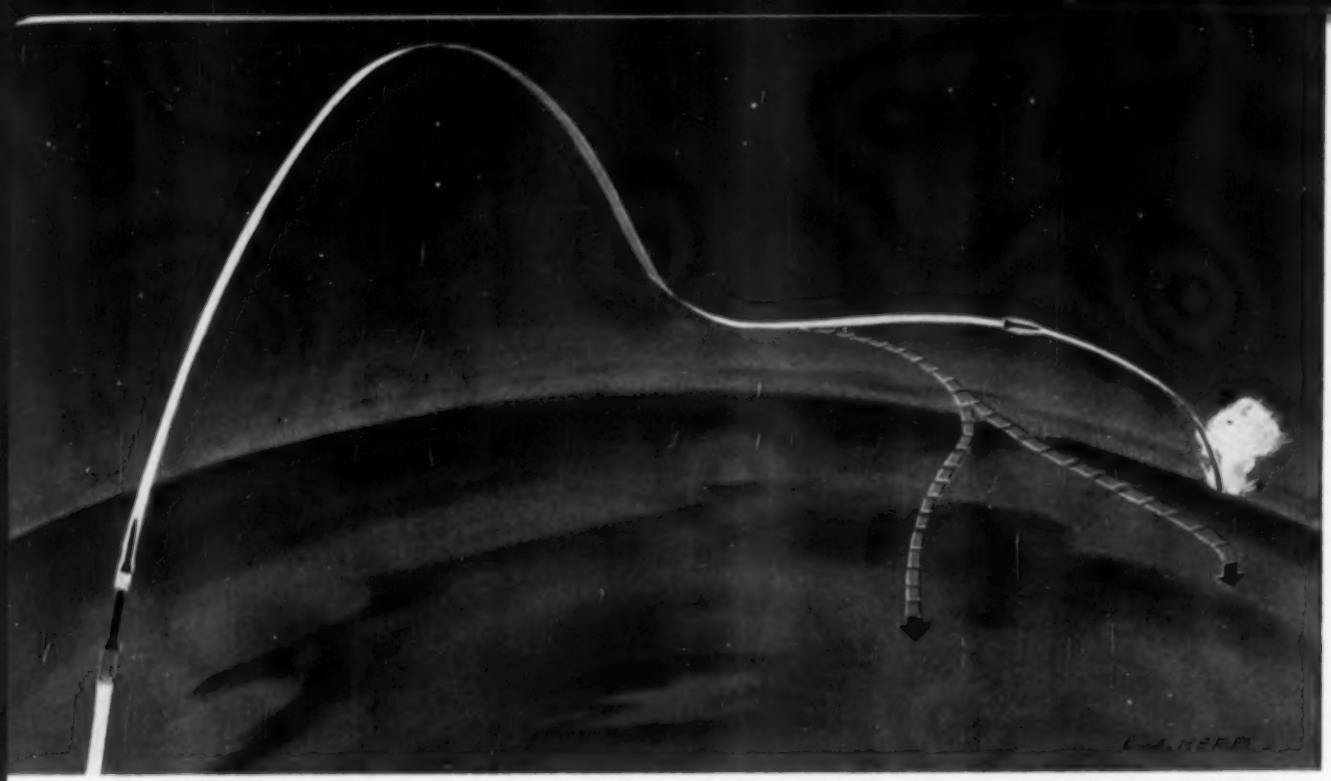
Information Test

Defense Department's professed intention of releasing more news about its modern weapon systems will get a new test this month with consideration of an Air Force proposal to declassify a sizable list of details. Included are external views of the Douglas Thor and Convair Atlas guided missiles. Final judge under current Pentagon security rules: Murray Snyder, Assistant Secretary for Public Affairs, who reputedly keeps his car on the White House door when about to make any decision concerning the release of information.

Independent CAA?

House Commerce Committee chairman, Rep. Oren Harris (D.-Ark.), says planned legislation to establish an independent civil aviation agency to replace Civil Aeronautics Administration under Commerce Department will be highly controversial in the next session. Two main points of dissension: whether Civil Aeronautics Board's air safety rule-making authority should be transferred to the new agency and whether it should be staffed by both military and civilian personnel.

—Washington staff



TRAJECTORY ABOVE has been proposed to give manned rocket planes transcontinental range or more. High velocity (above Mach 5) and high temperature research indicates that a vehicle shaped approximately like an artillery shell is more feasible for this trajectory than the craft which requires wings to land. The X-15 research aircraft will follow a similar flight path over a much shorter range; its relatively low speed will enable it to pass through the critical re-entry and pull-up phase safely. With ICBM and IRBM weapons, launching, burn-out and re-entry pull-up angles must be kept low to prevent re-entry heating and airloads from destroying warheads made of current materials. Once in the atmosphere the warhead can maneuver to evade defending missiles.

Ballistic Missile Has Glide Potential

Doubled range for IRBM, ICBM evasion capability are possibilities drawn from data in NACA reports.

By J. S. Butz, Jr.

New York—New, more ominous picture of ballistic missile warfare is emerging as data grows on the behavior of hypersonic (more than Mach 5, or more than 3,300 mph.) vehicles.

Combination of shallow or low angle firing and re-entry and glide technique may extend IRBM range from 1,500 to 3,000 miles, and may make ICBMs capable of evasive cruise above a target continent.

Missile Potency

This new ballistic missile potency is based on these results of wind tunnel tests and theoretical analyses:

- **Warheads** with the general shape of conventional artillery shells are able to pull out of low angle ballistic trajectories as they re-enter the atmosphere even at IRBM and ICBM speeds.
- **These wingless,** unpowered warheads can be efficient glide vehicles at speeds above Mach 5.
- **Aerodynamic heating** problems connected with the pull-out and glide can be solved with present knowledge.

The enormous kinetic energy which is dissipated in seconds during normal ballistic re-entry, almost burning up a warhead, can be put to much more efficient use. A warhead could use this energy to pull out, glide and maneuver to extend its range for evasion.

Severe Problems

This is not to understate the problem of designing a workable re-entry and glide warhead. It involves an extremely complicated interaction of aerodynamic heating levels and rates, mass ratio of the complete vehicle, range, trajectory, payload, guidance, etc. However, the problem has been defined for some time and such warheads are considered feasible with today's knowledge.

In the U.S. much of the theoretical work with glide warheads has been done at the Ames Laboratory of the National Advisory Committee for Aeronautics. H. Julian Allen and Alfred J. Eggers, Jr., Ames Laboratory scientists who played a prominent part in the effort to solve the problems of rapid re-entry along a true ballistic path, have also had major roles in NACA investigations of re-entry and glide techniques.

These NACA studies are an extension and refinement of the World War II reports by Eugen Sanger and Irene Bredt in Germany. A number of competent suggestions based on this work for the Germans have been made in Western nations for vehicles which can convert great speed into great range. Principal improvement on the Sanger-Bredt proposals has been a more detailed treatment of the aerodynamic heating problem.

Soviet Russia is as familiar with the original Sanger-Bredt studies as the Western powers are. In view of the competent use the Russians have made of other German ideas it is only reasonable to assume that they would attempt to improve the effectiveness of their ballistic missiles by developing the re-entry and glide technique.

The use of these techniques will greatly complicate the problem of anti-missile defense, considered to be a very formidable problem under any circumstances.

Most suggestions for the anti-missile defense of the U.S. rely on establishing the trajectory and target of an en-

emy missile somewhere between its maximum altitude and its impact point. Once the rigid trajectory had been established, batteries in the target area would launch defensive missiles head-on at the hostile warhead.

Anti-missile firing would probably be restricted to head-on angles because present computing and radar equipment is generally considered to be incapable of providing lead data for side shots at a large number of targets with the size and speed of an ICBM warhead. Without this lead data a high kill probability can only be achieved with a head-on attack and even then several defensive missiles would probably be launched to insure a kill.

Defensive Maneuver

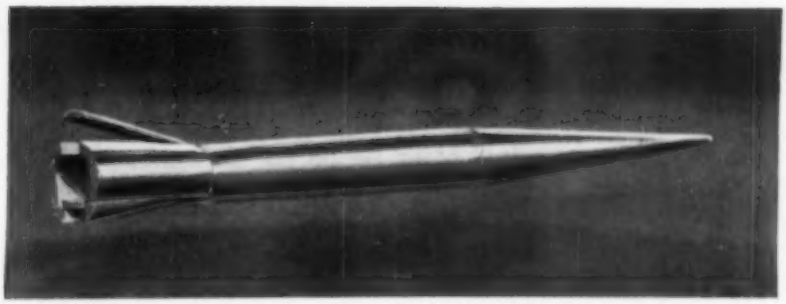
To foil these defenses, theory now visualizes an ICBM warhead preventing a head-on anti-missile attack by re-entering the atmosphere several hundred miles from its target. Upon re-entry, possibly over an ocean area, the warhead could change direction and approach the target at an altitude of less than 25 miles and an average speed of about 10,000 mph. The ability of this type of warhead to maneuver on its final approach to the target through the atmosphere could conceivably complicate interception to the point of impossibility for current rocket, guidance and computing systems.

A report presenting the basic theory and discussing the primary problems of hypervelocity vehicles has just been released by the NACA. This report TN 4046 entitled A Comparative Analysis of the Performance of Long Range Hypervelocity Vehicles was written by Eggers, Allen and Stanford E. Niece.

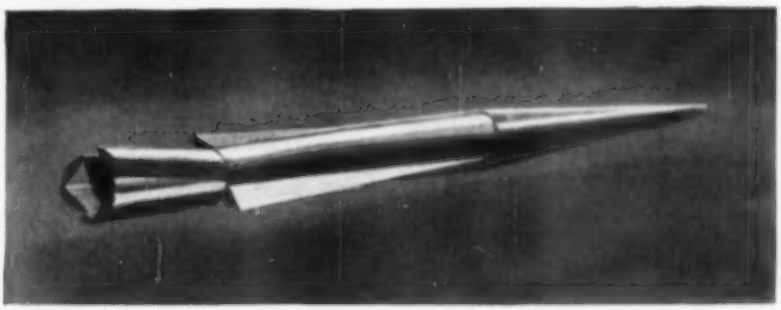
Hypervelocity vehicles fall into three categories as regards trajectories:

- **Ballistic vehicles** which follow a symmetric path from launch to impact.
- **Skip vehicles** which are launched along a ballistic path and upon re-entry use their lift to carry them back into space in another ballistic trajectory. This path resembles a stone skipping over the water.
- **Glide vehicles** which travel at best lift/drag ratio in the atmosphere.

The NACA authors compare the efficiency of the three types by calculating the vehicle each requires to deliver a given payload over a given range. Total weight is an indication of system cost. The powerplant, structure, etc. of each vehicle was considered to be equal. Their general conclusion was that the ballistic vehicle was inferior to the other types in the sense that it required the greatest velocity at the end of powered flight to attain a given range. Increased velocity requires a greater total weight and consequently greater cost.



HYPERSONIC theory shows that vehicles similar to the NACA suggestion above have lift/drag ratios only slightly less than a flat plate above Mach 5. Stability is provided by conical flare on the tail section. Deflecting portions of the flare afford afford control. Nose is slightly rounded to reduce local heating.



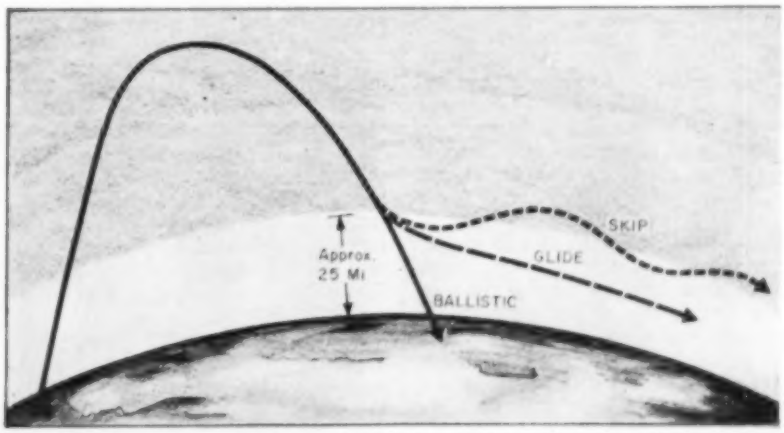
ADDITION of wings will compound heating problems. Required coolant load would go up, raising warhead weight which again would increase heating, necessitating more coolant, etc. Total vehicle weight goes up markedly before this cycle is completed and an adequate winged configuration is reached.

Efficiency Compared

The skip vehicle with a lift/drag ratio between 1 and 4 was found to be more efficient than both the ballistic and the glide types in converting velocity into range. However, it was considered to be substantially less promising than the others because of the aerodynamic heating problem and the loads associated with the skip.

The ballistic vehicle survives its re-entry by employing a very blunt, high drag shape to expend a large portion of its kinetic energy as pressure drag rather than as friction force. Glide vehicles are able to maintain a relatively low surface temperature by radiating a large fraction of their heat back to the atmosphere even though they have a low pressure drag and create a larger amount of friction.

Limited travel in the atmosphere keeps the skip vehicle from taking this much advantage of radiative cooling. The surface temperature therefore



RESEARCH GOAL is to join ballistic with the skip or glide trajectories. NACA considers the skip path unfeasible with current knowledge and materials. Ballistic-glide combination is possible if launch and re-entry angles are low. This cuts range of ballistic flight but can greatly increase total range.

raised considerably making it impossible for conventional structures to withstand the violent skip maneuvers, in the eyes of the NACA.

The glide vehicle was found to be far superior to the ballistic vehicle in the ability to convert velocity into range for lift/drag ratios of 4 or more. The best configuration for attaining this lifting efficiency at speeds above Mach 5 is considered to be a modified cone. Wings would be eliminated because of the severe heating problem they present which would raise the necessary coolant load and impose a severe weight penalty.

Theoretical Studies

Lift/drag ratio, surface temperature, coolant load and total weight are closely related. For example, theoretical studies with cones at hypersonic speeds indicate that for a lift/drag ratio of 4 the surface temperature would be about 1,500F, and for one of 6 it would be about 1,800F. Both temperatures can be handled by present materials and structures, but the coolant load would vary, as would total weight, cost, etc. This is typical of the design optimization considerations.

The stabilization of a glide vehicle of modified cone shape can be effected by flaring the afterbody. Pitch and yaw control can be accomplished by deflecting portions of the flared section.

Nose of this type of glide vehicle would be rounded to improve local heating conditions at this stagnation point.

Cone type configurations are adequate as long as the vehicle impacts at a speed of about Mach 5 or greater. If the vehicle must land intact, many more problems are introduced into the design.

Difference in Trajectory

This NACA report is presented in a basic manner and treats only the unpowered portion of the flight. The glide vehicle is considered to begin its flight at the upper limit of the atmosphere in a horizontal attitude. The ballistic vehicle travels into space in an elliptical path after its motor burns out.

The idea of combining either the ballistic and skip trajectories or ballistic and glide is an old one. Sanger & Bredt, Hsue-shen Tsien, Walter Dornberger, Krafft Ehricke and others have worked at this.

Main problem with a combined trajectory is the transition phase as the vehicle leaves the ballistic path. While the NACA and others reject the possibility of making the transition into the skip path with present knowledge and materials, enough basic information has been gathered through high speed and high temperature testing to show that ballistic and glide combination is possible under certain conditions. The main stipulation in these conditions is a relatively low angle of flight when the vehicle's motor burns out during the ballistic trajectory, so that the required pull-up angle will be low and heating and structural loads reduced. The light/drag ratio and slenderness of the conical vehicle is also a major consideration.

A safe conclusion from this information is that combining the range realized by the ballistic trajectory of current missiles with the glide range which is possible with a conical warhead will allow total missile range to be increased by a factor close to two. Addition of the glide trajectory will also provide a substantial maneuvering capability.

Guidance systems to control a combined trajectory will present many problems but the accelerative loadings and heating conditions experienced by the conical warhead are within the capability of many guidance packages currently employed.

A very interesting conclusion concerning the relative costs of hypervelocity vehicles and supersonic aircraft was reached by the NACA. On the basis of equal mass ratios at takeoff to mass at the end of powered flight they seem to be comparable for ranges equal to one-half the circumference of the earth or greater. Therefore, the hypervelocity vehicle in addition to the advantages of great speed has the very attractive possibility of offering economical flight.

Vanguard Satellite Materials Detailed

Washington—Variety of materials ranging from asbestos phenolic to an alloy of magnesium and thorium is used in construction of the Martin Co.'s Vanguard satellite launching vehicle.

Nose cone tip is made of titanium, chosen because it provides a good heat sink for temperatures in excess of 1,500F caused by aerodynamic heating. Weight is .163 lb./cu. in. compared to .284 for steel.

Remainder of the nose cone is made of asbestos phenolic. This was chosen for its low weight and ability to retain strength at expected temperatures of 800 to 900F. It weighs .065 lb./cu. in.

A magnesium-thorium alloy forms the airframe from the base of the nose cone to the top of the second stage tankage. Again, the metal was chosen for its lightness and ability to retain strength at expected temperatures—in this case, 600F. Weight is .068 lb./cu. in.

Second stage tankage is made of 410 stainless steel. Tankage in the Vanguard vehicle, as in its predecessor Viking rockets, is integral—the wall of a tank also is the wall of the vehicle. Fuel is unsymmetrical dimethyl hydrazine, with white fuming nitric acid as an oxidizer. Choice of stainless steel was based on corrosion resistance, ability to heat-treat and good strength properties. Internal pressures are the determining loads. Temperature is approximately 300F. Weight is .284 lb./cu. in.

Transition section and aft skirt are made from magnesium alloys expected to withstand approximately 300F. Weight is .068 lb./cu. in.

First stage tankage is 61S aluminum alloy, chosen because it is weldable and has good strength for buckling loads. Liquid oxygen tank temperature is approximately minus 350F and kerosene tank temperature is approximately 200F. Weight is .101 lb./cu. in.

Remainder of the vehicle below the tankage is magnesium, chosen for lightness. Temperature is about 100F.

Internal frames, longerons and thrust structure are made of 75ST and 24ST aluminum, chosen for lightness.

Gen. Anderson Warns Of Russian Threat

Dallas—U.S. must begin "a conservation program for airpower capacity" to meet "the Soviet threat to the scientific and technical lead," Lt. Gen. Samuel E. Anderson, commander of Air Research and Development Command, said last week.

"These are days of scientific and technical urgency—an urgency brought to a peak by the Soviet Sputnik," Gen. Anderson said, and this country must make "the most effective use of our scientific and engineering talent and the facilities and materials that go into the building of airpower.

". . . Unless we are very wise and prudent in the expenditure of our resources, we stand in danger of wasting our national wealth and strength."

Gen. Anderson spoke at a dinner during the two-day Institute of Aeronautical Sciences meeting here on Weapon Systems Management.

He called for "general advances in science and technology across the board" and said "predominant consideration must be on new and novel techniques oriented to provide significant breakthroughs to extrapolate Air Force operation into new frontiers of performance."

Industry must employ "the highest order of sound and economical management," Gen. Anderson said. ". . . We cannot afford the luxury of rejecting, ignoring or neglecting to make use of the knowledge and information which is derived or developed by others.

"The 'not invented here' complex has got to go," he said.

Soviet Shows Satellite-a-Month Capability

By Evert Clark

Washington—Second Russian earth satellite demonstrates a capability to launch at least one a month and confirms Soviet statements that the satellite program required an unprecedented single-project mobilization of scientific and engineering effort.

Even before Sputnik II was put into orbit with a female dog as its passenger, Russian scientists had stated flatly that Sputnik I was launched with an intercontinental ballistic rocket and had described a dual-purpose ballistic rocket that could carry "an atomic or thermonuclear warhead" or else "contain instruments or living beings in containers or space suits."

Russia is calling its new science of space flight "cosmonautics," a vastly more encompassing term than "astronautics."

Spur to U. S.

Tempo of activity for government, scientific and military leaders here was increased by Sputnik II's launching. Many already were working 12 and 14-hr. days to assess and try to counter Soviet achievements, prepare a Fiscal 1959 budget amidst confusion and changing policy, and educate not only a new Secretary of Defense but a Congress and a public that suddenly had developed voracious appetites for missile and satellite knowledge.

Sputnik II, weighing 1,120.29 lb., was put into orbit at an altitude of 1,056 mi. at an angle of 65 deg. north of the Equator. It contained a small dog of the Laika breed, similar to a Spitz, in an airtight, air conditioned container equipped with food and instruments for measuring heartbeat, respiration, blood pressure and temperature.

In addition to the instruments attached to the dog, Sputnik II contained instruments for measuring solar radiation, ultra violet radiation, X-rays and cosmic rays, and pressure and temperature, the Russians said. It also contained a power source and radio transmitters using 20.005 and 40.002 mc.

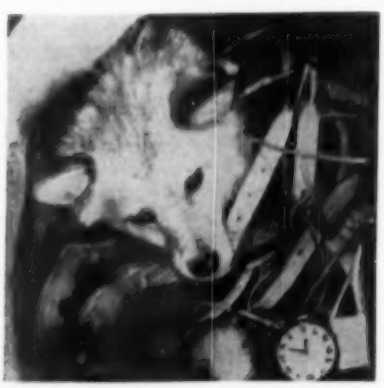
Orbital velocity was 17,850 mph.; apogee was 923 miles. Smithsonian Astrophysical Observatory in Cambridge, Mass., calculated the apogee as 1,056 mi., the same as the launch altitude, and said the perigee was about 104 mi.

Speculation was strongest late last week about these points:

• **Sputnik II's weight.** Russians at one point described the dog's container as conical, indicating that it might be the pointed forward end of the rocket or the forward end plus the third stage. Some U. S. observers doubted that the container alone weighed 1,120.29 lb. In mid-October, Yury Pobedonostsev and K. Malyutin wrote in the Russian weekly magazine New Times: "The . . . intercontinental rocket produced in the Soviet Union made possible approximately a month later the launching of the (first) artificial earth satellite." In an article titled "Road to Cosmos," Pobedonostsev described the rocket as wingless and cigar-shaped. When it is used as a military weapon "its forward compartment contains an explosive charge such as an atomic or thermonuclear warhead," he said. When it is used for research, the forward compartment "contains instruments or living beings in containers or space suits."

THIS is Laika dog orbiting in photo made during training for flight in Sputnik II.

• **Fuel used in Sputnik II's** launching rocket. Soviet scientist Cyrill Stanyukovich said that a liquid "super-fuel" was used. Observers in the U.S. said this term might refer to an "exotic" fuel. Others doubted that anything more advanced than liquid oxygen and alcohol would be required to launch the dog's container if the weight given by the Russians also includes the third stage rocket, but they do not discount the possibility that a "super-fuel" was used. Russians have been working with most, if not all, advanced chemical fuels known to the West, and Stanyukovich's article in Trud said they also are working on photon rockets.



HARNESSED dog in pressurized ascent.

SOVIET dog after a rocket flight recovery.

• **Recovery of Laika,** a name that doubles for the breed and the dog, and means "Little Barker." Soviet statements have been contradictory. U. S. observers say recovery is possible but difficult (see p. 30) and say the perigee of Sputnik II may be 40 mi. lower than Sputnik I in order to get the dog down easier. Prof. Anatoli A. Blagonravov said in a Moscow broadcast a day after the launching that "the life of the dog is safe." In Soviet Aviation, Medical Scientist W. Malkin wrote that a great deal of work had been done on the problem of returning the dog to earth. An East Berlin Communist newspaper said Laika's cabin would be ejected from Sputnik II "after a certain time" and landed by parachute after a three-hour, braked flight. Slow descent would allow calculation of the landing site, the paper said.

Apes Are Next

Anthropoid apes will be the next space passengers, according to the official Communist newspaper Pravda.

Soviets also have created conditions similar to those that would be encountered on a flight to Mars, according to Dr. Vitaly Romadin, identified by radio Moscow as a Soviet scientist.

Professor L. J. Sedov wrote in the East Berlin paper "Young World" three days after Sputnik II was launched that "at the present time projects are being investigated for a rocket trip to the moon as well as around the moon, with

Russians Build 12-Ton Payload Helicopter

Twin turbine engine helicopter unveiled by Russians for 40th anniversary of the Russian Revolution can carry a 12-ton payload to an altitude of 7,500 ft., Soviets report. Russians reportedly carried 80 passengers in the new helicopter, the Mil-6, which is about twice as many as the biggest U. S. helicopter, the Sikorsky S-56, carries. Normal gross weight of the S-56 is 28,500 lb. Four blades are clearly visible on the Russian helicopter. Part of what may be a fifth is visible above the pylon behind the engine intakes. S-56 has five blades. U. S. helicopter engineers who saw the Mil-6 photo did not dispute the Russian load figures, for which new records have been claimed.

a return of the rocket to earth."

Air Force researchers at the Missile Development Center, Holloman AFB, N. M., compared signals received from Sputnik II with telemetry records made on animal-carrying rocket flights in this country but said they had not deciphered the Russian code. One Navy official estimates it will take three months to decipher coded signals recorded from Sputnik I's transmitter, which died three weeks after the launching.

Soviets have not yet provided the key to the signal.

Scope of Russia's effort in the space flight field is indicated by this statement from Editor Vasily Zakharchenko, in the scientific magazine Tekhnika Molodezhi:

"Thousands of people worked to build the Tu-104 jet transport; scores of thousands of people helped to construct our first atomic power plant. But it is impossible to enumerate the great army of workers who have built the first satellite."

Soviet scientists also have been free with criticism of U. S. missile and satellite efforts.

Prof. Blagonravov was quoted as saying: "In rocket techniques, the U. S. A. is not doing badly but it is far behind the U. S. S. R."

Prof. Pobedonostsev wrote that Russia "has left the U. S. behind in the field of intercontinental, multi-stage ballistic rockets. The U. S. models, which have been so widely advertised all over the world, have failed to pass the test and have not justified the money spent on them."

Dog Recovery Viewed as Feasible

New York—Chances of bringing the dog in Russian Sputnik II down to earth safely are fairly good in light of recent U. S. studies. Suggestions for re-entry satellites carrying living creatures have ranged from completely spherical shapes to hemispheres with small stabilizing fins to round nose bodies with small wings.

Whether such satellites are unpowered or have small amounts of power for deceleration and positioning purposes, the main requirement for successful re-entry is a trajectory which makes a small angle with the horizontal. If this small angle with the horizontal can be maintained as the satellite skirts the upper atmosphere, deceleration forces and aerodynamic heating can theoretically be kept within the limits of human and structural endurance.

One proposal by A. J. Eggers of the National Advisory Committee for Aeronautics considered a re-entry vehicle the approximate size of Sputnik II. The NACA vehicle would weigh 1,250 lb. and have a hemispherical shape of 10 ft. diameter.

Under ideal conditions with the low re-entry angle this vehicle would experience a maximum deceleration of only 7.2Gs and the total time that the deceleration would be more than 1G would be about 3 minutes.

Maximum equilibrium surface temperature of the hemispherical vehicle would be in the neighborhood of 2,500 F. This indicates that radiative cooling and the use of ceramic outer surfaces may be adequate for such a vehicle.

Senators to Probe 'Entire' Missile Field

By Katherine Johnsen

Washington—Congressional concern over Russia's satellite launching appears destined to bring clashes with some Administration leaders at Senate hearings scheduled to begin late this month under the chairmanship of Sen. Lyndon Johnson (D.-Tex.), Senate majority leader (AW Oct. 14, p. 31).

Other members of the Preparedness Subcommittee, which will conduct what Johnson termed "a searching inquiry into the entire field" of satellites and missiles, are Sen. John Stennis (D.-Miss.), vice chairman; Sen. Estes Kefauver (D.-Tenn.); Sen. Stuart Symington (D.-Mo.); Sen. Styles Bridges (R.-N. H.); Sen. Leverett Saltonstall (R.-Mass.), and Sen. Ralph Flanders (R.-Vt.).

Indicative of the importance of this investigation is Johnson's decision to preside—his first active committee participation since becoming majority leader. Other members of the Armed Services Committee are being invited to take part in the hearings as ex-officio members. These include Sen. Henry Jackson (D.-Wash.) and Sen. Sam Ervin (D.-N. C.) who joined with Symington last year in a sharply critical evaluation of Administration slowdowns in the aircraft and missile programs (AW Feb. 4, p. 32).

Redstone Hearings

The subcommittee's attention will focus on the Army's missile program. This has been requested by Sen. Mike Mansfield (D.-Mont.), Senate majority whip.

Johnson has announced that one of the first activities on the agenda will be hearings at Huntsville, Ala.—home of Army's Redstone Arsenal and Army Ballistic Missile Agency. Subcommittee hearings will be held later in Los Angeles and Baltimore, he said.

Highlights of Johnson's observations after a seven and one-half hour briefing at the Pentagon were:

• **"Russia is ahead of us. . . .** The U.S. is lagging in both the satellite and missile programs" and "feeble denials of the facts of life" do not remedy the situation. Russia "has handed us both a technological and propaganda defeat."

• **"There is no reason** to believe we cannot catch up—that is, if we apply the necessary determination, will power and money." Apparently taking note of the Administration's "business as usual approach" which has become increasingly irritating to subcommittee members, Johnson added: "But, it is clear a conservative approach to the space age will not guarantee American leadership. Russia's achievements are truly remakable."

Johnson called for "bold decisions by cool heads," cautioned against "panic over our own lagging program—because panic never produces any answers."

Referring to references in some quarters that Russia's satellites are "balls or primitive gadgets without military significance," Johnson commented: "They may be decisive developments—the Wright brothers' plane was a primitive gadget, too."

• **There is** "no question that we were not in a race with Russia on the satellite program." Of two choices, a military crash program or a purely scientific program, the U.S. chose the latter approach. He questioned this decision, adding that under a crash approach the U. S. "had both the know-how and ability to launch a satellite some time ago."

• **"Ways must be found to speed up** (satellite and missile) programs. Instead of the 1960 and 1965 target dates now indicated, we must have 1958, 1959, and 1960 target dates."

'Subsidize' Education?

Johnson said the coming session of Congress will consider legislation to "subsidize" the education of both teachers and students in science and engineering.

"I am much more concerned over the U.S.'s failure in the training of engineers and scientists than I am with its failure on the earth satellite," he said. "The most significant feature about the Russian satellites is the knowledge and application of technological skills that they reflect. . . . There are grave implications in terms of rocket and missile development, but the most serious implication is what they tell us about the state of Russian technology."

Johnson said an intercontinental ballistic missile under a crash program "could rapidly become obsolete and another 'Maginot Line.' He added: "There is an immediate requirement for a family of missiles to safeguard the U.S., but this is not nearly as important as producing a family of engineers to save our country."

Johnson repeatedly emphasized that the subcommittee's attitude would be cooperative but significantly added, "We may be critical if criticism is justified or called for, of Defense Department or Administration leaders who have set policy on the missile-satellite program."

Pentagon Briefing

Sen. Richard Russell (D.-Ga.), chairman of the full Armed Services Committee, and Sen. Styles Bridges (R.-N. H.), the senior minority member, attended the Pentagon briefing session, in which Defense Secretary Neil H. McElroy, Deputy Secretary Donald A. Quarles and Gen. Nathan F. Twining, chairman of the Joint Chiefs of Staff, participated.

Presentations were made by Maj. Gen. R. J. Wood, Army Deputy Chief of Research and Development; Rear Adm. Rawson Bennett, Chief of Naval Research; Richard E. Horner, USAF Assistant Secretary for Research and Development, and Brig. Gen. A. W. Betts, military executive to W. M. Holaday, Special Assistant to the Secretary of Defense for Guided Missiles.

The staff of the subcommittee has been gathering basic information on the satellite and missile programs since the Oct. 4 launching of Sputnik I. This, along with a staff evaluation, was presented to subcommittee members last week.

Sen. Saltonstall is the only member of the subcommittee who has been in line with the Administration attitude toward the Russian satellite launchings. Both of the other two Republican members have been critical of the Administration's lack of urgency (AW Oct. 28, p. 25).

Following the lengthy Pentagon briefing, Bridges repeated that he is "deeply concerned with the over-all progress" of the U. S. satellite-missile program and called for the appointment of a "missile-satellite coordinator," responsible only to the Secretary of

Base Changes

Washington—USAF's internal economy effort has resulted in two new changes in its base setup:

• Consolidation of the Air Proving Ground Command and Armament Center at Eglin AFB, Fla. New single center will be operated by the Air Research and Development Command.

• Inactivation of the 461st Tactical Bomb Wing, Blytheville, Ark., will be carried out by the end of the year. The base will be taken over by a unit of the Strategic Air Command.

The Arkansas inactivation will affect 250 officers, 1,800 airmen and 200 civilians. Most of them will be moved to other TAC installations.

The consolidation at Eglin AFB will save several million dollars annually and release some first and second line aircraft for use by other commands.

Maj. Gen. Robert W. Burns, present commander of the Air Proving Ground Command, will head the new center.

Defense and the President, to eliminate duplication and assure that all programs "are guided to a common purpose." He said the launching of Sputnik II "should have stripped any remaining mask of complacency on the part of thoughtful persons" and that the Russian challenge is "in dead earnest."

Bridges said the U. S. is "ahead" in the field of short-range missiles and that this, coupled with a ring of overseas bases, would temporarily give the U. S. a superior military position. But he demanded an "an all-out effort to maintain our position." He urged that the congressional investigation "not pin the blame for past errors on any particular individual or group. We have no time to lose."

Mahon Visits Schriever

Meanwhile, there were these other Congressional developments:

• **House Appropriations Subcommittee** on the Armed Services headed by Rep. George Mahon (D.-Tex.) prepared for consideration of the Fiscal 1959 defense budget early next year by opening a closed-door investigation of the missile program with a session with Maj. Gen. Bernard A. Schriever, commander of the USAF Ballistic Missile Division, and Holaday at Schriever's Inglewood, Calif., headquarters. Later, the subcommittee visited Convair test and manufacturing facilities at San Diego for the Atlas intercontinental ballistic missile; the Aerojet General liquid rocket facility, and the Douglas Aircraft Co. Thor IRBM test site at Sacramento. The subcommittee plans a briefing session with McElroy and Quarles in Washington and inspections of the Redstone Arsenal and Patrick AFB, Fla.

• **Staff of House Military** Government Operations Subcommittee headed by Rep. Chet Holifield (D.-Calif.) moved forward with a fact-finding study of anti-missile programs in connection with legislation to place civil defense under the Department of Defense.

• **Sen. Charles Potter** (R.-Mich.) urged the appointment of a cabinet-level secretary to direct science programs—a proposal which also has been made by Sens. Kefauver and Mansfield.

• **Sen. Symington declared** that, despite the launching of two satellites, "nothing" has been done to accelerate the defense program. With operational intercontinental ballistic missiles "years" in the future, Symington protested that the "plans and programs for existing forces should be ones of acceleration instead of deceleration."

• **Sen. Jackson said** the size of Sputnik II and the distance it was propelled from the earth "give us reason to suspect the Soviets may have achieved nuclear rocket propulsion ahead of us."

In line with the still existing congressional economy drive, there were these moves:

• **House Civil Service Subcommittee** headed by Rep. James C. Davis (D.-Ga.) opened hearings on the "poor utilization" of scientific manpower by Defense Department and the "pirating and hording of engineers under defense contracts."

Davis charged at the beginning that this has stemmed from "the almost unbridled competition growing out of unlimited defense dollars. It must not be allowed to continue if we are to win supremacy over the Russians."

• **Sen. Wallace F. Bennett** (R.-Utah), former president of the National Assn. of Manufacturers and an Administration spokesman on economic matters, declared that "the problem of keeping the dollar sound is every bit as important as that of rocket research—and perhaps even more important. . . . We cannot permit the current news from Russia to serve as an excuse for fiscal irresponsibility. If we do, we may find that we have irreparably damaged the basic economic strength of the nation, which, in the long run will provide the ultimate victory over world communism."

New USAF Funds Ease Cutbacks But Economy Efforts Continue

By Claude Witze

Washington—USAF and its major aircraft industry contractors, assured that money will be available to pay all reasonable bills in the next eight months of Fiscal 1958, continued their efforts last week to economize where possible.

With at least an additional $300 million now available for Air Force procurement in the next few months (AW Nov. 4, p. 26), it was apparent that adjustments are being made in two areas:

• **Contractor expenditure** estimates in general have been revised downward. This does not mean that all companies found it necessary or possible to reduce their estimated billing, but many were forced to adopt more realistic arithmetic. In some cases, this involved an admission that earlier figures were somewhat inflated.

• **Production schedules** are being revised in some cases to make them more conservative. Company representatives still are being called to Air Materiel Command Headquarters in Dayton, Ohio, to consider adjustments that will be acceptable both to the manufacturers and the Air Force.

Minor Adjustments

A USAF spokesman told AVIATION WEEK any adjustments will be minor and that there will be no changes—stretchouts or cutbacks—for the single purpose of saving money. "Our only determination," he said, "is to get unrealism out of the schedule if it is there."

It was anticipated that the Dayton sessions will be finished by the end of this week.

In a telegram to 28 major USAF contractors, Air Force Secretary James H. Douglas gave the industry credit for undertaking the financing of some work-in-progress under cost-plus contracts.

These actions, Douglas said—together with pledges of a continued economy effort—make it appear that USAF will be able to pay its bills. Douglas suspended the previous expenditure allocations imposed on contractors about one month ago under the spending ceiling imposed by Charles E. Wilson, then Secretary of Defense.

Research Repairs

In the area of research and development, where Neil H. McElroy, Wilson's successor, ordered restoration of at least $170 million slashed off the available cash last August, contracts are being restored on a selective basis.

First priority in repairing the damage to the research effort was given to universities, many of whom had their programs severely upset at the start of the college year by sudden USAF cancellations (AW Sept. 16, p. 26).

A spokesman said last week that not all contractors in the research area have received notice of renewal, but that the task of sorting out the best possibilities and ordering work renewed should be finished in another couple of weeks.

He reiterated that not all contracts will be restored. USAF will take the opportunity to drop some with relatively poor prospects of paying off in useful information. On the other hand, it is expected that new projects will be undertaken.

Pratt & Whitney Layoff

Pratt & Whitney Division of United Aircraft Corp., East Hartford, Conn., announced it will lay off about 5% of its employes by the first of the year. Reason given by William P. Gwinn, United president, is that the pipelines are filled with Pratt & Whitney jet engines and some of the scheduled 1958 output must be postponed until 1959. Gwinn said the stretchout is due to cuts in military aircraft production

schedules, practically all of which were announced in midsummer.

Gwinn said shipments for all of United Aircraft Corp. in 1958 will be at least as great as those for 1957 despite the readjustments in Pratt & Whitney schedules.

The jet engine plant payroll of 40,000 will be cut by about 2,000. Six hundred will be released immediately. Hamilton Standard division will retain its present force of about 11,500, and Sikorsky Aircraft Division will continue to carry 10,000 employes.

Medium-Range Circuit Transistors Developed

Dallas—Texas Instruments has developed two new diffused-base silicon medium power transistors to fill the gap between commercially available low power and high power transistors.

The new transistors will permit design of transistorized medium power circuits utilizing their four watt at 25C case temperature and one watt at 150C case temperature dissipation ratings, according to Texas Instruments.

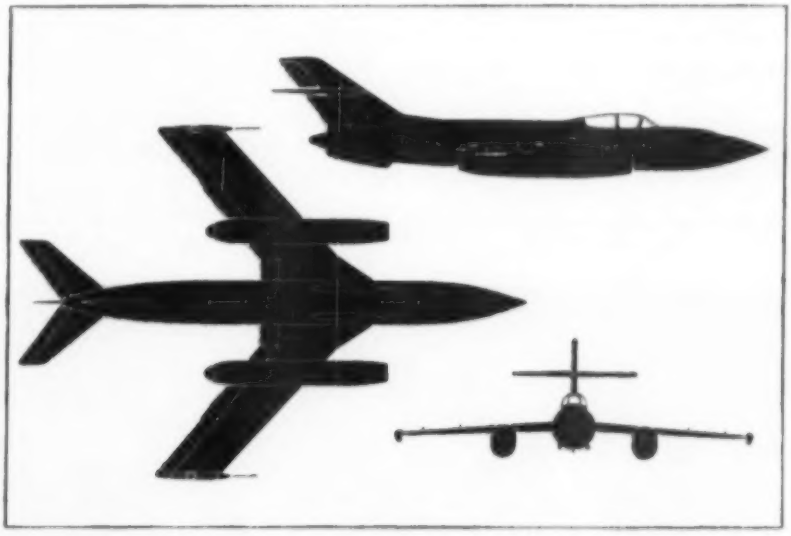
Both transistors have a typical saturation resistance of 20 ohm at 25C, plus an operating range of minus 65C, to plus 200C. They are temperature stabilized at 215C. Company said these diffused base transistors are well adapted to high temperature switching applications because of high peak currents resulting from one watt/150C dissipation and 20 ohm saturation ratings.

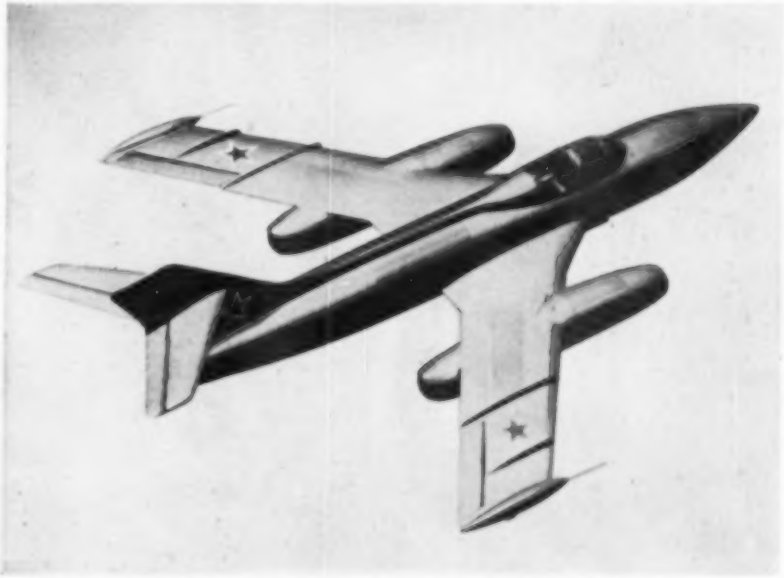
One of the new transistors is a 60-volt unit and can be used with 28-volt power supplies used in various military aircraft. The other is a 100-volt device for use in higher voltage applications. The transistors have an 800-milliwatt free air temperature rating, an eight-volt minimum emitter-to-base rating and a typical static forward current transfer ratio of 20.

Boundary Layer Control Cuts F-104 Stall Speed

Boundary layer control for Lockheed Aircraft Corp's F-104 pipes high-velocity air from jet engine into wing, where it is blown from slotted tube out over the upper surface of the trailing edge wing flap. Use of BLC reduces F-104's landing or stall speed by 20 mph., cuts landing distance by one-quarter.

When flap angle passes 15-deg. mark, automatic valve begins to open. Full-open position is reached when flap is completely extended at 45 deg. Running the entire 47-in. length of the flap, the BLC tube has 55 slots. Slots are placed 0.9 in. apart, center-to-center. Each slot is 9.09 in. deep and 0.55 in. wide. Air flows through slots and over flap at 2,300 fps.





Soviet's Develop Flashlight C

Flashlight C, Russian all-weather night fighter interceptor, is believed to have afterburners on its twin jet engines for Mach 1 performance. Overall span of the two-seater is 40 ft. Overall length 55 ft., gross weight 30,000 lb. Plane resembles single-seat light bomber Flashlight B. Both planes are developments of earlier blunt-nose Flashlight A.

KC-135 Aerial Command Post Evaluated at Andrews for SAC

Washington—Prototype of a Boeing KC-135 aerial command post will be stationed at Andrews AFB for the next three months to evaluate its elaborate radio communications equipment.

The aircraft, a special version of the KC-135 jet tanker now in production at the Boeing plant near Seattle, Wash., carries four single sideband transmitters. It is capable of instant communication with any point in the world while cruising at its regular speed of about 600 mph.

Communications Link

Application of the KC-135 flying communications center by the Strategic Air Command probably will be as a command post from which a mission can be directed with full coordination with all ground and airborne elements.

SAC now has radio equipment capable of linking headquarters at Offutt AFB, Omaha, Neb., with all major bases and the command aircraft.

On a typical mission involving the Boeing B-47 or B-52 jet bombers, it would be possible for the commanding officer to keep in touch with these units in addition to USAF's Air Materiel Command, Air Defense Command, Tactical Air Command and even the White House. This is a radio tieup not considered practical with existing radio equipment.

Its utility in the event SAC is forced to take part in a "brush-fire" or peripheral type war would be greatly expanded, particularly if the command had no convenient site for a ground headquarters.

On a recent flight from Seattle to Andrews AFB, a 2,340-mi. trip flown in four hours and eight minutes, the KC-135 was in clear communication with such scattered points as Saudi Arabia, Paris, Thule, Africa, Bermuda and the Far East.

On its flights out of Andrews AFB in the next three months, the equipment will be tested and evaluated for range, interference from icing and precipitation, types of equipment and general operational suitability. No pattern has been set for the flights, but it is assumed they will range over most of the world.

Prototype Design

Initially, the radio gear installed in the big Boeing jet is equipment designed by USAF, Collins Radio and the Eldico Corp. Some of this may be changed as the experiments continue.

The prototype aircraft has two six-foot probe antennas, one on each wingtip. In addition there are two long wire antennas mounted between the roof of the cabin and the vertical stabilizer. The probes can be remotely tuned to resonate at any selected frequency. The wire antennas have good

Shrouded Atlas ICBM Is Transported to Florida Test Center

Shrouded for security, an Atlas intercontinental ballistic missile is transported from San Diego plant of Convair Division of General Dynamics Corp. to the Air Force Missile Test Center, Cape Canaveral, Fla. Atlas is 80 ft. long, 10 ft. in diameter (AW Sept. 2, p. 28).

electrical characteristics, but are considered inferior to the probes in mechanical stability.

Introduction of single sideband equipment for SAC purposes grew out of experiments conducted by Gen. Curtis E. LeMay, now USAF vice-chief of staff.

When he headed SAC, Gen. LeMay tried SSB equipment in a command aircraft and found on one trip that he could communicate with 58 different countries and get the benefit of improved reception.

The equipment is more expensive than the customary radio receivers and transmitters used in transport and bomber aircraft. However, it provides new economy of operation, longer service life, relative freedom from interference and long-range reliability. Another major advantage is that several conversations can be carried on over the same frequency, because there is no standing carrier signal. Two or more stations can work on the same frequency so long as they do not talk at the same time.

Fund Ceilings, Soviet Progress Challenge Industry, Irvine Says

By Craig Lewis

Dallas—Fixed military expenditure ceilings and startling Soviet military and scientific advances are pressing challenges for U.S. industry, according to Lt. Gen. C. S. Irvine, USAF deputy chief of staff, materiel.

"Within the bounds of these two circumstances, American industry must redouble its efforts to conserve resources, to engineer vastly improved hardware and to produce on time the effective, reliable air weapon systems which the Air Force must have," Gen. Irvine said in a speech written for the Temco Aircraft Corp. Management Club.

When Gen. Irvine had to cancel his date with the Temco group, his speech was read by Brig. Gen. Luther S. Smith, USAF ret., assistant to Temco President Robert McCulloch.

Criticism of USAF

Reviewing recent steps taken by the Air Force to reduce costs, Gen. Irvine observed that the first move was to cancel such projects as North American's Navaho intercontinental missile and the Republic F-103 and to stretch out such programs as Boeing's Bomarc interceptor missile and the Century series aircraft.

These economy moves caused severe criticism of USAF, and Gen. Irvine observed that the gist of this criticism was, "We didn't know what we were doing and that we were making some serious mistakes.

"I assure you here and now, we did know what we were doing," he said. "On the basis of giving top priorities to those systems which could provide the most or the quickest operational improvements and graduating priorities throughout our entire procurement program, we canceled or stretched out at the lower end of the scale."

"If we made mistakes, they were in the details of taking actions, not in the actions themselves," he said.

The USAF materiel chief said the primary effect of the expenditure controls will be a more realistic approach to accounting methods and cost estimates. "Ball park guesstimates will not be acceptable as a basis for progress payments."

Since the Air Force will have to operate on a pay-as-you-go philosophy, Gen. Irvine said USAF will have to pro rate cash outlays according to its evaluation of company estimates to avoid exceeding "cash-on-hand" operating funds.

Air Force also is reducing the size of progress payments prior to delivery of the first article, Gen. Irvine told the Temco group. He said companies with fixed price contracts will have to carry 30% of their operating costs instead of 25%, and that companies with cost-plus fixed-fee contracts "can no longer depend on the Air Force for 100% support prior to first article delivery as they have in the past.

Gen. Irvine said that when USAF took these actions, it believed that procurement programs could be continued without further cutbacks and stretch-outs, but that experience is proving that this is not true. Industry has told USAF that programs cannot keep the present pace within reduced operating funds, he said, and "since we cannot increase the amount of our checks to them, the only alternative may be to review our procurement actions once more."

Dollar control is a pressing challenge which can be met only by very close USAF-industry cooperation, Gen. Irvine said. "In a sense, it is a wall on one side of our pathway toward building advanced air weapon systems. On the other side, and pressing closer all the time, is the rising wall of Soviet engineering and scientific progress."

Discussing Soviet advances, Gen. Irvine observed that the Russians have long-range bombers that can deliver nuclear weapons and high performance interceptors. "While there may be doubt as to the degree of refinement engineered into these aircraft, there is little doubt that they could be used effectively against us," he said.

The Soviets also are vigorously applying advanced electronic and rocketry know-how into new systems, he said. He said the U.S. doesn't know whether the Russians have operational ICBMs and IRBMs, "They will use every scientific trick they can acquire or discover to have these weapon systems in their active inventory before we do."

Soviet Engineer Output

Gen. Irvine noted that Russia is educating young scientists and engineers with an annual output twice the U. S. rate and that his visit to the USSR last year indicated that these students are being trained with most recent types of equipment and by seemingly well-qualified instructors.

Soviets also back their own pool of knowledge with a vigorous information gathering agency that collects published documents and reports from all over the world, translates them and channels them quickly to the proper scientists and research centers, he said.

To meet these challenges, Gen. Irvine repeated warnings that management must do its part by reducing overhead costs, as well as direct labor costs and overtime pay expenses. He said management must also re-align comptroller functions to fit the more stringent requirements of expenditure controls and make accounting procedures compatible with accrued expenditure computation.

Engineers' share of the challenge demands more "brainpower" output per engineering and design hour than has been the case, he said. "Less effort should go toward frilly refinement, and more of it toward better performing, radically new equipments and systems."

Engineers should also get away from "not invented here" complex, he said, and make use of information and designs available elsewhere.

Gen. Irvine said industry must provide more pounds of hardware per man-hour at the production level. He said it is becoming more important to use improved production methods and equipment, that more automation is essential, although he warned that automation should be used to increase output per hour and not to reduce payrolls.

British Air Rescue Group Plans Arctic Rehearsal

London—British Air Rescue Group plans to parachute eight men onto the North Pole in May to investigate conditions that would confront rescue teams after a plane crash or forced landing. Sponsor of the project is the Council of Management of the Polar Air Rescue Expedition of 1958.

Newspapers Discuss Secrecy Issue

(*Continued from page 21*)

leading to a grave surprise when Sputnik was unveiled.

Mr. Cutler got to a closed meeting of business leaders last week and touched on this subject in his speech. It is reported that he grew quite excited and used the word treason. He also is said to have suggested retaliation against the magazine, through withholding of advertising, was not only feasible but desirable. These are strong words. They are stronger when it is realized that the so-called breach of security at which Mr. Cutler takes umbrage is one of clear importance to the American people. That has been shown by the spate of activity since Sputnik to convince us that we are, after all, not so badly off in the missiles field.

Mr. Cutler has a reputation for keeping his counsel and believing that secrecy is the best policy. Fortunately, United States Representative John Moss has started an immediate inquiry into just what Mr. Cutler did say, and how it can be reconciled with a free government. It can't. Mr. Cutler ought to remember these words of Thomas Jefferson, written long years ago when another government agent was considering withholding some information: "Your fellow citizens think they have a right to full information, in a case of such great concernment to them. It is their sweat which is to earn all the expenses of the war, and their blood which is to flow in expiation of the causes of it."

The Passion for Secrecy . . .

Louisville Courier-Journal

In the last two years the House Information Subcommittee has done good work to restore the public's right to know how its business is being run. It has exposed shocking instances of the tendency in federal agencies to suppress information—and exposure has forced some helpful changes.

But now the committee, under Chairman John E. Moss of California has an even uglier situation to explore. This is whether government policy is to encourage punishment by boycott or secret denunciation of publications daring to publish information the government prefers to keep secret.

The fact that this question arises at all is due in itself to the government's passion for closed-door meetings at which public business is discussed. Robert Cutler, White House liaison officer to the National Security Council, addressed such a meeting of businessmen—the Commerce Department's Business Advisory Council. The press was barred, but some who heard him were shocked enough to talk.

Some of his hearers thought they heard Mr. Cutler suggest an advertising boycott of AVIATION WEEK, the trade publication which on October 21 revealed that the U. S. has been tracking Russian missiles on special radar equipment in Turkey. Some said Cutler described the story as one of the worst breaches of military security in years, a "treasonable" disclosure. And so on.

The White House has issued denials of the boycott suggestion and quoted Mr. Cutler's adjective as being "shameful" instead of "treasonable." But Chairman Moss very properly wants to get a full report of the goings-on at Hot Springs by questioning Mr. Cutler himself.

Whatever the Information Subcommittee may discover, one thing already is plain. The government has no business substituting off-the-record attack before an audience of businessmen for the actual public prosecution of AVIATION WEEK which a White House spokesman says is possible.

Another result of the Hot Springs rumors is the large suspicion that AVIATION WEEK's real "shame" is exposure of the fact that the government for more than two years has been suppressing knowledge of Soviet missile achievements—two years in which such suppression led the American public to accept with complacency repeated cutbacks in our own program.

As Editor Robert Hotz maintained when he published the story, our radar-observation program was a secret from no one "except the vast bulk of the American people." The Russians, the Turks, and just about everybody else knew about it, he said—statements confirmed by other Washington reporters and supported by the logic of circumstances.

If the government wishes to disprove these statements and to prosecute AVIATION WEEK for an actual breach of security regulations, let it make its case in the courts. In the meantime, we may hope that the mere launching of Chairman Moss's probe will discourage anew Washington's constant temptation, as he has described it, "try and put a secret stamp on everything"—especially on everything that might embarrass it.

And if any more publications are to be attacked, let's hope it is by public accusation and legal prosecution, not by secret denunciation before defense-industry leaders who might not even need to hear the word "boycott" before deciding that doing business with the publication denounced would be poor contract-policy indeed.

Leaks vs. Light

Los Angeles Examiner

How far should the government go in withholding information from the American people in the interests of security? This question has been raised anew by Loyd Wright, a past president of the American Bar Association who headed the Commission on Government Security.

Wright has urged enactment of legislation which would penalize, with fines and/or prison terms, newsmen and others who disseminate government "secrets."

He told the American Society for Industrial Security, meeting in Washington, that he had been assured such legislation will be "one of the first orders of business" when Congress meets in January.

The real rub of this issue is, of course, who shall say what is "secret."

Bureaucrats are all too prone to "classify" information which the people have a right to know.

Sometimes it's merely a case of petty officials playing safe.

But the secrecy label also can be used to cover up serious mistakes, or worse.

There have been a few exceptions, but by and large the American press has an admirable record of cooperation with the government when national security really is involved.

Legislation which would punish newsmen for revealing information which some Pentagon bureaucrat arbitrarily labeled "secret" is a dangerous infringement upon the people's right to know.

To shut off so-called "news leaks" in this manner all too often results in shutting out the light by which the American people can see what their employes in the federal government are up to and how they are spending their money.

This isn't the way to achieve genuine security, which is essential to the safety of the nation, but is the way to unjustified censorship, which is abhorrent to the nation's traditions of freedom.

. . . Revealing Secrets . . .

Dallas Morning News

A dispatch from Washington says that a bill will be introduced in Congress providing fines and imprisonment for

newspapermen and others who reveal government "secrets."

Loyd Wright is a civilian head of the Commission on Government Security which has been studying this problem.

AVIATION WEEK magazine published a story disclosing that the United States for some time has had radar equipment in Turkey recording missile firings by Russia.

"I regret that anyone would not think more clearly of the possibilities of assisting the enemy before publishing that type of thing," Wright said.

But where did AVIATION WEEK get the story? Somebody in charge of our Turkey radar unit—assuming there is one—tipped off somebody else who tipped off somebody else who tipped off the magazine.

AVIATION WEEK cannot have correspondents all over the world. No newspaper or publication can. In revealing "secrets," the government itself is the worst offender, and the revealing is done often to grind an axe or by one branch of the military trying to show its superiority over the other.

But all forms of media, to avoid stricter regulation, should exercise greater judgment. Freedom of press and speech can remain only if the country is secure. Destruction of that security is destruction of all its freedoms.

In wartime voluntary censorship worked well. Patriotism was high, of course; it always rises in the face of peril.

The danger of a law fining and imprisoning reporters who reveal "secrets" is the government's inability to define secrets. The 1,500-odd bureaus and commissions in the federal government constantly will enlarge the area of restricted information, until research on the sweet potato will be considered a secret. We will have government by blackout. The first step toward security is for the defense forces to protect their own secrets. The next step is for all media to exercise care and caution, remembering that all freedoms can vanish with reckless indiscretion.

News Digest

English Electric P.1B interceptor has been flight tested supersonically for the first time with de Havilland Firestreak infrared missiles, with which it will be equipped. The test was reported to have been satisfactory, with no adverse effects on P.1B performance at high speeds. Firestreaks are mounted close to the fighter's fuselage on each side of the nose.

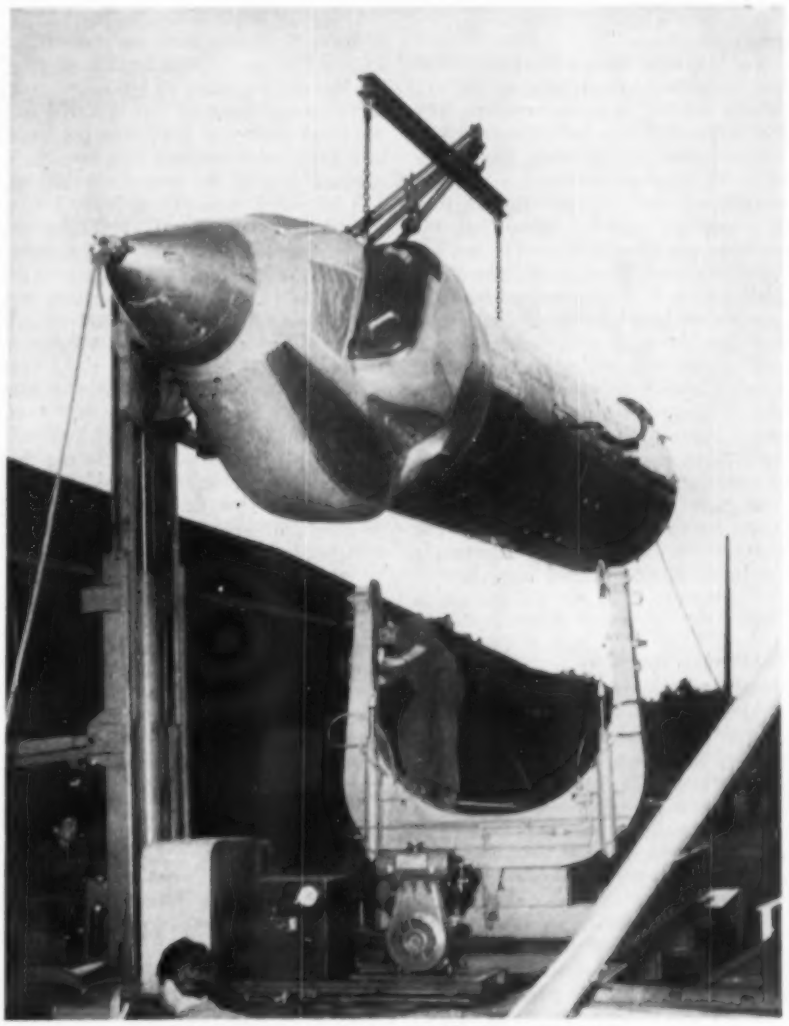
Lockheed's Missile Systems Division, Palo Alto, Calif., is using a 40-ft. shock tube to test advanced designs of the Navy's Polaris ballistic missile. Temperatures and pressures generated within the tube will simulate those a long-range ballistic missile would encounter in flight at speeds of 13,000 mph.

New order for Nord Co's CT-20 target missile has been placed by British Supply Ministry. Missile, powered by Turbomeca Marbore turbojet, will be used by Royal Navy.

Henri Potez, aviation pioneer and head of the French aircraft firm which bears his name, has purchased controlling interest in Air-Fouga, builder of the Magister jet trainer. Air-Fouga shares formerly were jointly owned by five French aviation companies.

French have fired missiles from under belly of delta-wing Gerfaut experimental interceptor at supersonic speeds, say tests are probably first of their kind to be conducted in Europe. Experiments are being made at Istres.

Japanese Government approval of a technical tie-up with Contrabes A G of Switzerland has been requested by Mitsubishi Electric Manufacturing Co. The agreement, valid for 15 yr., would cover the domestic manufacture of Oerlikon ground-to-air guided missiles and firing control systems for anti-aircraft guns.



Flatcar Is Atar P3 Test Rig

Latest version of Snecma's Flying Atar, the manned P3, is rigged on a railway flatcar for tests to determine effects of relative wind flow on the jet exhaust of the VTOL vehicle. Atar will be mounted horizontally behind high powered locomotive. Jet exhaust directed in direction of train movement will simulate conditions of vertical descent. French State Railways are cooperating in tests, which will utilize straight stretch of track in Melun area, near Paris. Cockpit arrangement, inverted in photo, and covered intakes are discernible. P3 will be test flown only in vertical flight, but P4, its successor, will begin conversion. Vehicle uses basically an Atar D turbojet (AW Aug. 5, p. 50).

Airline Earnings Point Toward New Low

Industry profits show sharp dip in third quarter; earnings for 1957 may fall below $50 million.

By L. L. Doty

Washington – Airline earnings for 1957 appear headed for the lowest level in three years. Profits continued to dip sharply during the third quarter of the year despite a marked increase in passenger revenues.

An AVIATION WEEK survey of domestic trunkline activity during the 12 months ending Sept. 30 indicates net profits for 1957 may fall below the $50 million mark for the first time since 1953. Estimated profits for the 12 months are $46 million, compared to an actual net profit of $59 million for the same period of 1956.

Furthermore, although estimated revenues for the 12 months ending Sept. 30 indicate revenue growth is continuing to follow the healthy development pattern of the industry, passenger traffic during October fell short of forecasts. Should this downward trend in passenger traffic continue through the winter months, an even deeper depression in earnings can be expected.

Highest earning record for the industry was established in 1955 when the domestic trunkline carriers reported a net profit of $63 million compared to $51 million in 1954 and $57 million in 1956.

Passenger Increase

On the strength of the present survey, a 10 to 12% increase in passenger traffic can be forecast for the year. Although this estimate compares favorably with a long-range forecast of 8 to 12% each year during the next five years, it is substantially below the 16% gain experienced during the past five years or the 25% increase recorded during the 1940-51 period.

Operating expenses showed no signs of slackening during the 12 month-period, indicating the airlines are getting no relief from the profit pinch which has plagued the industry since the fall of 1956. Of the Big Four airlines, only Trans World Airlines reported any control of the mounting expense level. It announced a reversal in the climb of costs per available ton-miles during the first nine months of the year.

Estimated operating revenues for the domestic industry during the 12 months surveyed amounted to $1.3 billion as compared with an actual $1.1 billion in the 12 month period. Operating revenues reached an estimated $1.4 billion against $1.2 billion in the same period last year.

Operating Revenues

Using an index system as one means of fixing a sharper focus on the airline financial picture, operating income during the third quarter of 1957 is shown to be almost one-half that reported for the third quarter of 1955. On the basis of a 1955 index figure of 100, operating expenses during the period climbed to 114 in 1956 and to 137 in 1957.

Operating revenues climbed from an index base of 100 in the third quarter of 1955 to 109 for the same period in 1956 and 125 in 1957. Operating income, however, dropped sharply from the 1955 index base to 70 in 1956 and to 57 in 1957.

During the first eight months of the year, available seat-miles rose 16.7% as compared with a 12% increase in 1956. Deliveries of new equipment during the next six months may bring this increase to as high as 25% in 1958 unless retirement of old equipment is accelerated to a higher rate than has been experienced so far.

Average passenger revenue per passenger-mile dropped to 5.27 cents during the first nine months of 1957, compared to 5.28 in 1956. The trend in this category has been consistently downward every year since 1951 and is probably the direct result of the steady growth in aircoach service.

Fare Increase?

Airlines consider the decline in the average passenger revenue per passenger-mile a significant sign that a fare increase is needed as a key step toward maintaining sufficient revenue increases at a pace at least equal to expense increases.

That the investing public also feels the need for a fare increase as a means of insuring a fair yield on common stock is shown by the sharp rise in airline stock prices on the New York Stock Exchange 10 days ago when word spread through Wall Street that Civil Aeronautics Board staff members were supporting a higher rate of return for the carriers.

For the nine months ending Sept. 30, Trans World Airlines showed a substantial improvement over the same period for 1956. Net income climbed to $2.4 million compared with earnings of $461,000 through the third quarter last year.

Net income before taxes this year was $5.6 million of which $3.6 million was from transport operations and $1.9 million from the sale of aircraft. The airline's international division produced a $2.4 million profit before taxes on total revenues of $51 million, compared to a $1.2 million profit generated by domestic operations from gross revenues of $148 million.

TWA's costs per available ton-miles were sliced from 29.4 cents in 1956 to 28.3 cents in 1957 on domestic routes and from 48.3 cents in 1956 to 44.8 cents in 1957 on international routes.

Retarded Traffic Growth

Carter Burgess, TWA president, emphasized the failure of the industry traffic volume to meet expectations and said retarded traffic growth was reflected in September results when earnings before taxes slid from $2.9 million in September, 1956 to $1.5 million for the same month in 1957.

Capital Airlines also reversed last year's trend with operating revenues pulling above operating expenses during the nine months of 1957. In 1956, operating revenues totaled $45 million as compared with operating expenses of $47 million for the first three quarters. This year, revenues climbed to $69 million and expenses reached $68 million.

The carrier turned its three quarter operating loss of $1.8 million in 1956 into an operating income of $1 million this year. Net loss was cut from $2.8 million in 1956 to $1.7 million for the first three quarters of 1957.

Eastern Air Lines reported a sharp decline in profits for the first nine months of 1957, although operating revenues hit an all-time high for the carrier. Expenses increased 27% during the period causing a 59% decline in earnings.

Load factors dipped from 62.70% to 61.03%.

Eastern pointed out in its third quarterly report that wages were up 26% over the first nine months of 1956. Fuel costs increased 31%. Total net earnings for the airline were $4.9 million for the nine-month period, compared to $8.1 million in 1956.

United Air Lines beat its own nine-month record gross during the first three quarters of 1957 by more than

$14 million, but net earnings dropped from $10.1 million last year to $6.3 million this year. Operating revenues climbed from $200 million during the nine-month period of 1956 to $214 million for the same period this year. Expenses rose from $176 million to $199 million.

United's third quarter revenue passenger-miles climbed 12%, but available seat-miles jumped 15% during the same period.

During the first nine months of the year, United added 27 new four-engine planes to its fleet.

Delta Air Lines reported a passenger traffic increase of 18.33% during the September quarter—first of the airline's current fiscal year which ends June 30, 1958.

The airline, however, recorded a 20.68% increase in operating expenses for the three month period. Net income for the period was $356,000 on gross revenues of $20.5 million, an 18% increase over the corresponding period in 1956.

Reduced Earnings

American Airlines reported a big decline in earnings from $17 million during the first nine months of 1956 to $10 million for the same period in 1957.

Net earnings per share of common stock including profit on disposal of property dropped from $2.15 to $1.23 during the two periods.

Total revenues increased from $217 million in 1956 to $231 million this year.

Expenses climbed from $201 million to $223 million. During the nine month period, American carried 6,152,871 passengers, a total of 3.9 billion revenue passenger-miles, a 6.7% increase over the 3.6 billion revenue passenger-miles for the same period last year.

The airline moved 64.6 million ton-miles of airfreight during the first nine months of the year, an increase of approximately 24.8% over the same period last year.

Northeast Setback

Northeast Airlines suffered a marked setback for the first nine months as the result of a jump in gross expenses from $7.8 million in the 1956 nine month period to $13.3 million this year.

Net loss for the first nine months of this year reached $2,369,465 compared to a $66,378 loss during the same period last year.

Revenues were up to $11 million from the 1956 figure of $7.8 million, but the airline began to feel a traffic slump in September. The September load factor slipped to 42.32% from 55.19% in August and from a 57.71% figure in September, 1956.

Fare Probe Begins Next Week; Domestic Lines Renew Efforts

By Ford Eastman

Washington—Domestic trunk airlines will renew their efforts next Monday when hearings begin in the General Fare Investigation to prove that the industry needs a fare increase despite a favorable past earnings record.

Airlines say a fare boost is necessary because costs are increasing faster than revenues, lowering profits and reducing chances of obtaining the financial backing necessary to move into the jet age. Rate increases asked by various carriers range from 6% to 20%.

Difficult Task

The task is not expected to be an easy one. Civil Aeronautics Board turned down requests for a 6% emergency increase in September on the grounds that evidence presented did not support the airlines' contention that the increase was necessary to provide an adequate return.

The Board said its decision was based upon the level of earnings necessary to provide a fair return over a reasonably extended period, including both good and bad years. The yardstick used to measure the earnings level by the Board was an 8% return on investment as applied in domestic rate proceedings.

CAB said average past earnings have been substantial and have exceeded the 8% level, even on a reported basis. The average rate of return for the 12 trunklines from 1950 through 1956 was 11.67%, according to the Board. The 1955 average return was 11.58% and the 1956 return was 9.42%.

Best Years

The period between 1950 and 1956 is generally considered the best ever attained by airlines from a financial standpoint.

Although the Board took notice of declining profits last year and this year, it concluded that on the basis of the record the present depressed earnings appeared due to short-term factors. It said no evidence had been submitted to show that airlines could not cope with the downward trend in profits.

Throughout the opinion that accompanied the decision, CAB repeatedly pointed out what it termed the lack of substantiated arguments it could take into consideration in determining the issue of whether present fares were inadequate or not. Among these were:

• **Evidence shows that the carriers** have had substantial earnings in the past, and they have not established that the economic and operational factors—which in the past afforded opportunity for reasonable earnings, under economical, efficient management—will not be obtained in the future.

• **There is no evidence** that such a level —8% rate of return—was inadequate in the past, and no carrier has introduced evidence into the record supporting a different rate of return. The position of the carriers is that they are submitting a dollar amount of earnings for the Board's consideration as to reasonableness, without advocating any particular rate of return.

• **Main argument advanced** in this proceeding in support of the position that cost increases can no longer be absorbed is that the new turbo-compound aircraft are more costly than their predecessors. However, no carrier other than United has offered underlying evidence to support this proposition.

• **Most of the carriers contend** that the heart of their case is the requirement that earnings be kept at a reasonable level in order to maintain investor confidence and obtain financing for their jet programs. They contend that, otherwise, their credit status will be seriously if not irreparably impaired. The difficulty with this claim is its lack of adequate support. There is no evidence as to any inability on the part of the trunkline industry generally to obtain necessary financing for replacement or expansion needs. No testimony was offered from members of the financial

Capital Wants Subsidy

Washington—Capital Airlines asked the Civil Aeronautics Board last week for a return of subsidy payments to protect it against an estimated 1958 net loss of $7.5 million. The airline was last removed from subsidy payments in October, 1951.

In a petition filed with the Board Wednesday, Capital asked for subsidy mail payments of 30.73 cents per revenue plane-mile in addition to the air mail service rate it now receives. The carrier said it was faced with an emergency situation and doubted its ability to operate without subsidy because of a critical financial condition.

Capital told the Board it would incur an estimated $7.5 million net loss in 1958 on revenue of $97.6 million at the present rate of return. It added that a 20% fare increase, which the airline described as a "very remote possibility," would permit a $5 million net profit on $116 million gross revenues.

community as to the level of earnings the carriers would require in order to obtain additional financing.

Hector's Stand

Board Member Louis J. Hector, who filed a separate concurrence, summed it up this way:

"One aspect of the case seems to me of particular significance. The carriers' case for an emergency increase is based in large part on the claim that present passenger fares do not produce sufficient earnings to enable the carriers to raise the capital necessary for their jet equipment programs.

"Yet the record, to my mind, contains little real evidence on this subject. In general, the carriers' cases rest on the unsupported assertions of their own executives that an immediate fare increase is necessary for them to complete their equipment financing arrangements."

From its opinion, the Board left little doubt what carriers must present in the way of evidence to justify a fare increase. Hector even offered some suggestions. He said that, if a fare increase is justified in order to finance these equipment programs, the Board must require convincing proof that these programs are reasonable and economically and financially feasible.

"It seems to me," he said, "that a convincing presentation of the carriers' equipment programs and their related financing needs should encompass something like the following:

- **"Long-range traffic projections,** including traffic stimulation anticipated from the introduction of jet aircraft.
- **"Aircraft purchase** and disposal programs related to introduction of jets.
- **"Financing plans necessary** to accomplish the purchase of aircraft.
- **"Rate of return or level** of earnings necessary to accomplish financing.
- **"Passenger fare levels** necessary to achieve the required rate of return.
- **"Evidence that the proposed** increases are compatible with the traffic projections with which the planning begins."

From exhibits already exchanged in the General Passenger Fare Investigation it appears that the airlines are following the advice. Early exhibits contain considerable written testimony from financial experts regarding airline financing.

Other Issues

Other issues or questions that will appear during the investigation include:

- **Accounting procedures.** Are reported airline expenses in line with the yardstick used by the CAB in the past during rate proceedings to determine justifiable expense? In the past, millions of dollars of reported airline expense have been disallowed by the CAB as not justified under economical and efficient management. Inclusion of all expenses, whether justified or not, would tend to depress profits reported by airlines.
- **Profits reported by airlines** also will be affected by method used to depreciate equipment, depending upon the life allowed for the aircraft and the residual value. The CAB staff, in the 6% case, submitted a method that reflected greater profits than the airlines reported.
- **Carriers also contend** that, in reviewing the adequacy of their earnings, capital gains should not be taken into account since they are infrequent, nonrecurring and not income in the ordinary sense because they must be ploughed back into new equipment. The Board ruled this argument had no merit in the 6% case, but that it might have in the investigation.
- **Airlines have contended** that equipment deposits should be a part of the investment base. Bureau Counsel eliminated this in the 6% case. By including equipment deposits in the investment base, the rate of return would be decreased unless offset by an increase in profits.
- **Carriers would like to figure** unit costs on the basis of available seat-miles instead of revenue-miles. This would reflect in the showing of higher costs and depressed earnings in rate cases.
- **Airlines contend the current drop** in load factors is due to increased competition from recent route awards and will not improve. CAB admits new competition, particularly in the initial stage, presents airline management with serious scheduling problems. It adds, however, that this is a temporary condition and can be overcome once a carrier has sufficient information to determine the needs of the market.
- **Airline routes and use** of equipment also may come in for scrutiny. For example, CAB probably will want to know if profits are being depressed by larger trunks serving too many of the short haul markets or by utilizing equipment that is uneconomical in a certain market. Considering the relatively high costs of selling and boarding traffic, the Board said the length of haul is a major critical factor in a carrier's earnings potential.

Another question that may be asked of airlines, and one which the carriers would probably like to know too, is—once the jets have been flying a few years, what fare level will be necessary to permit an adequate return on a long term basis?

Britannia Crashes

Bristol, England—Bristol Aeroplane Co.'s prototype Britannia 300 crashed while on a test flight killing all 15 persons aboard.

The company said the aircraft was engaged in strain gauge testing shortly before the crash. It plunged to the ground in the landing pattern at the company's Filton home base while turning on a final approach.

First eyewitness reports said the Britannia "broke up in the air" but a company spokesman said there was nothing to suggest that there had been an explosion. Hugh Stratham, Bristol assistant chief test pilot, who was at the controls, had time to radio a brief "Mayday" signal before the crash.

The 15 persons aboard the aircraft included eight Bristol flight test crewmen, as well as observers from the Air Ministry, de Havilland Aircraft and Rediphone Co. Bristol said the crash had no connection with engine icing problems which have plagued the Britannia. It was reported recently that the company was soon to begin testing the latest engine modification aimed at whipping the icing problem.

This modification was not being tested on the aircraft which crashed, a company spokesman said, adding that there was no engine test of any type being conducted at the time of the accident.

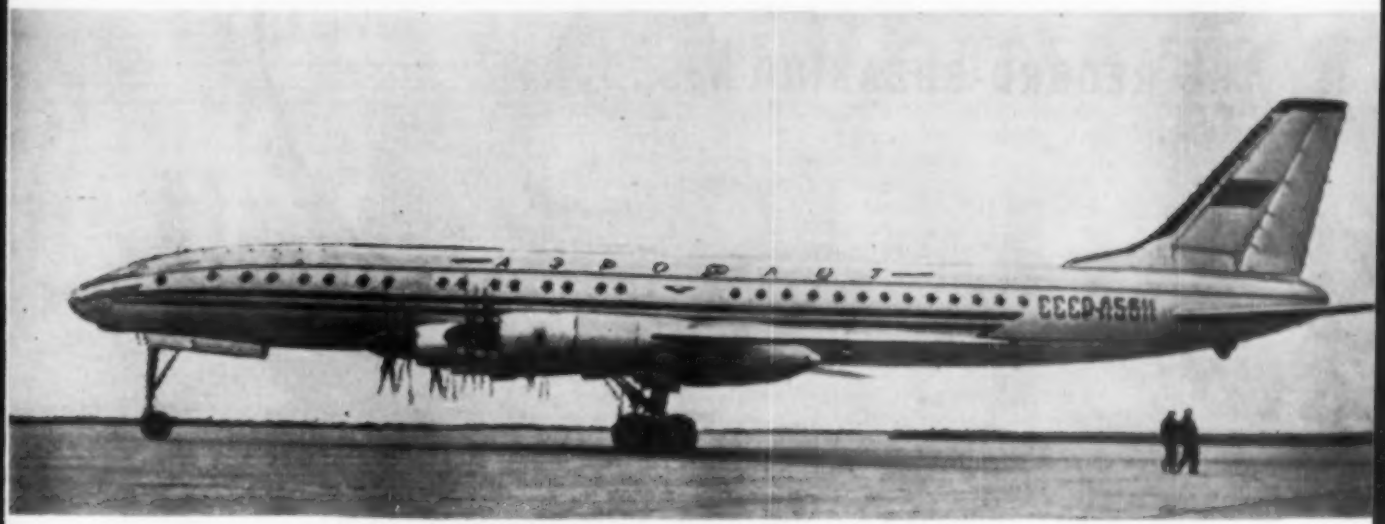
Chicago-Miami Route Proposed For National in Great Lakes Case

Washington—National Airlines was recommended last week to fly the choice Chicago-Miami route by Civil Aeronautics Board Examiner William F. Cusick. Delta and Capital Airlines also were recommended to serve additional markets through extension of routes.

In his initial decision in the long and involved Great Lakes-Southeast Service Case, Cusick selected National over several other applicants, including Capital, Capitol Airways, Northwest, Trans American, Trans World and United.

The case covered a number of applications for services in a broad area between the Great Lakes and Southeast sections of the country bounded by Chicago, Detroit and Buffalo on the north; Indianapolis, Louisville and Atlanta on the west; Washington and Baltimore on the east, and Tampa and Miami on the south.

There were 10 applicants in the case, five carrier intervenors, 34 civil intervenors and 35 appearances by interested parties outside the bounded area. The



Russia Unveils Huge Tu-114 Turboprop

New Soviet airliner, the Tu-114 Russia, is powered by four turboprop engines similar in appearance to 12,000 eshp. powerplants of the Bear bomber. Aircraft, Russians say, is equipped with two elevators, telephone system and 48-seat restaurant. Moscow-New York nonstop performance with 170-180 passengers at 560 mph. cruise is claimed for the aircraft, designed by group headed by A. N. Tupolev.

decision contained 358 pages in addition to eight pages of tables. Cusick's recommendations are:

• **Certification of National Airlines** to operate between Chicago and Miami via Indianapolis, Louisville, Knoxville, Atlanta, Tallahassee, and Tampa (St. Petersburg) Clearwater, with a restriction that Atlanta be served only on flights operated between the terminals Chicago and Miami.

• **Extension of Delta Air Lines** from Cincinnati to Detroit via Dayton, Columbus and Toledo and the certification of Tampa (St. Petersburg) Clearwater and Orlando as intermediate points on the route between Miami and Jacksonville, with a restriction prohibiting turnaround services between Cincinnati and Detroit. Also the extension of the same route from Savannah to Charleston.

• **Extension of Capital Airlines** from Pittsburgh to Buffalo via Youngstown, Akron, Canton, Cleveland and Erie and from Atlanta to Miami via Jacksonville, Tampa (St. Petersburg) Clearwater and West Palm Beach, with a restriction prohibiting operations between Erie and Cleveland except on flights also serving Atlanta or Miami and with a further restriction prohibiting turnaround service between Atlanta and Miami.

• **Extension of Eastern Air Lines** from Charleston, W. Va., to Chicago via Cincinnati, subject to a restriction prohibiting flights between Charleston and Chicago that do not originate or terminate in Columbia, S. C., or points south. Also, extension of Eastern from Louisville to Detroit via Cincinnati and Fort Wayne subject to a restriction prohibiting turnaround service between Detroit and Cincinnati.

• **Revision of Trans World Airlines** certificate to remove the long-haul restriction prohibiting turnaround services between Chicago and Washington and to remove restrictions prohibiting service between Cincinnati and Indianapolis.

• **Revision of United Air Lines** certificate to remove a long-haul restriction prohibiting turnaround services between Chicago and Washington to authorize service between Chicago and Washington via Dayton and Columbus.

• **Revision of Northwest Airlines** certificate to authorize unrestricted operations between Detroit, Cleveland, Pittsburgh and the coterminals Washington and Baltimore.

Rotodyne's First Flight

London—Forty passenger Fairey Rotodyne, designed as a VTOL transport, made its first flight last week at White Waltham Airfield. Flight lasted 20 min. and was vertical only. Rotodyne has fixed wing and rotor.

Russia, U.S. Dispute Bilateral Progress

Washington—State Department last week denied that discussions with the Soviet Union on a bilateral air agreement had begun, although an official of the Russian embassy told AVIATION WEEK "negotiations are now under way."

A State Department official said the Russian proposal for an air agreement with the U.S. was included as part of a discussion program covering ways and means of expanding the exchange of ideas between the two countries (AW Nov. 4, p. 41). He said, however, the program includes some 50 agenda items and added the Russians have not yet touched on the bilateral proposal nor have they hinted they are ready to discuss it. Discussions on the first few agenda items started last Monday.

The Soviet official strongly implied that the proposed air pact would soon materialize but refused to elaborate on any of the details of the plan.

Meanwhile, Pan American World Airways, which holds operating rights to Moscow and which once was authorized by the State Department to negotiate with the Russians on an air agreement (AW Aug. 27, 1956, p. 25), had received no official or unofficial word by late last week from either the Soviet Union or the U.S. that bilateral discussions are imminent.

New Comet Planned

Hatfield, England—De Havilland Aircraft Co. plans another version of its Comet 4 jet transport, to be known as the Comet 4C. Designed for operation over intermediate stage lengths, it is expected to provide almost the payload of the Comet 4B with maximum stage length increased by 300 mi. Comet 4A has been dropped.

THE RECORD-BREAKING VISCOUNT

BEA reports...

VISCOUNT FLEET MAKES PROFIT OF OVER 3 MILLION DOLLARS IN ONE YEAR!

During the 1955-56 fiscal year British European Airways' fleet of jet-prop Vickers Viscounts operated at a clear profit of $3,180,000 — or $68 profit per flying hour for each Viscount.

And during this same period, BEA's competitive position was greatly improved. On their Great Britain-Europe services — mostly Viscount — BEA's share of market rose to 56% while the number of passengers carried increased 19.9%!

BEA comments, "The Viscount has earned high praise from passengers, crew and ground staffs alike. The Viscount has shown serviceability superior to that of any previous new BEA aircraft on introduction to full airline service."

Similar results are reported from all of the 17 other airlines throughout the world which are now flying Viscounts. More evidence that *"wherever the Viscount flies, traffic figures rise"!*

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SHORTLINES

▶ **Emery Air Freight Corp.** reports a record net income for the third quarter of 1957—$181,491, equal to 26 cents per common share. Third quarter revenues rose from $2,345,626 in 1956 to $2,902,126 in the third quarter this year. Net income for the nine months ending Sept. 30 was $540,827.

▶ **Trans World Airlines** claims a new non-stop record from New York to Frankfurt, Germany. A TWA Lockheed 1649 Constellation made the trip in 10 hr. 15 min., cutting 15 min. from the record set by a Lockheed Super-G Constellation last Jan. 29.

▶ **Harvard University School** of public health in Boston is conducting a post graduate study in aviation health and safety. Study was made possible by a $250,000 grant from the Daniel and Florence Guggenheim Foundation in New York. There are 13 persons enrolled in the course, including military and civilian physicians and engineers from several nations.

▶ **Scandinavian Airlines System** is adding some new special luxury features on its Douglas DC-7C "Royal Viking" flights from New York on North Atlantic flights and Los Angeles on transpolar flights. The new services include inflight chefs, gourmet meals with Swedish crystal, Danish porcelain and silver cutlery, comfort socks and sleeping masks. Steaming towels will be provided to men for the morning shave; eau de cologne will be presented to all passengers.

▶ **Provincetown-Boston Airline** reports its 1957 traffic figures were 40% above 1956 operation. The local airline began its 1957 season on May 17 and completed it on Sept. 29. It flew 8,608 passengers on 1,315 flights over its route. During the summer, only 25 flights were canceled due to bad weather. PBA also carried 2,257 lb. of cargo from Provincetown to Boston, 632 lb. were carried southbound.

▶ **British Overseas Airways Corp.** has become world wide agent for Hong Kong Airways. BOAC will handle all reservations for the airline.

▶ **Qantas Empire Airways Ltd.** has flown the first non-stop flight from Honolulu, T. H., to Sydney, using a Lockheed Super-G Constellation equipped with special wing tip fuel tanks. The Constellation made the 5,175 mile flight in 22 hr., 18 min. Average speed was 230 mph.

AIRLINE OBSERVER

▶ Watch for increased emphasis on reservations handling and telephone sales techniques as competitive battle for dwindling winter traffic reaches a peak this year. Added competitive schedules on profitable routes are forcing carriers to take every measure that will prevent a loss of potential telephone sales because of busy signals, unanswered telephones and low caliber selling styles. Chief passenger complaint now is against being asked to wait on a hold-key or dead telephone until a reservationist is free to handle the request. Problem has been compounded by high volume of calls from passengers seeking to cancel reservations in accordance with the no-show penalty requirement.

▶ **Airlines do not appear to be at a loss for words in explaining the reasons why they believe there should be an increase in air fares. Exhibits and written testimony exchanged in the General Passenger Fare Investigation to date already reach more than three feet high.**

▶ Fear is emotional factor most strongly associated with air travel according to a scientific research survey conducted by bio-mechanics laboratory of Tufts University. Employing a new technique of social and clinical research, the Tufts group found that air travel is associated with a variety of feelings, led by anxiety, recklessness, impropriety and speed. On the other hand, rail travel is associated with such feelings as propriety, slowness, pleasurable gregariousness and a "slight foolishness." Persons interviewed for the survey had traveled at least 200 mi. by either air or rail within the previous year.

▶ **Flight Engineers' International Assn., AFL-CIO, is fighting an independent union's attempt to wrest representative rights at United Air Lines. The new union, United Flight Crew Members Assn., has filed a petition with the National Mediation Board to conduct a mail election in its first move to pull membership away from FEIA, and AFL-CIO affiliate. Nationally, FEIA now represents 648 flight engineers or about 90% of all U.S. engineer crew members.**

▶ Independent Airlines Assn. has asked the U.S. Circuit Court of Appeals to end its stay of an injunction against the railroads issued in District Court July 17. The supplemental airline group claims that a minimum $316,116 revenue loss to the railroads was incurred by its carriers during the past three months as a result of the stay. The injunction was stayed, pending appeal, on Aug. 1. It had been granted as a result of a $45 million anti-trust damage complaint—later increased to $144 million—brought by Aircraft Aircoach Transport Assn. and 30 of its members.

▶ **North Central Airlines shareholders have approved a stock split plan that will increase authorized common stock from 750,000 to 3,700,050 shares. Under the plan, each share of the airline's present stock will be exchangeable for five shares of the newly authorized stock.**

▶ American Airlines is planning a seat configuration on its Boeing 707 jet transports of 140 seats for coach flights, 100 for first-class flights. First-class configuration may include four abreast seating arrangement in every other row alternated with rows of five abreast seating.

▶ **Airlines will curtail Christmas gift expenses this year as a direct result of mounting costs. Capital Airlines has told employes that the Christmas tree baubles which the airline has been circulating every holiday season since 1951 in lieu of Christmas Cards will not be available this year. Eastern Airlines also has told employes that company-purchased cards will not be authorized this year.**

▶ Trans World Airlines will hire at least 40 British girls for hostess training this winter. A selection board of six TWA personnel experts were in London last week interviewing applicants.

▶ **Northwest Airlines has petitioned the Civil Aeronautics Board to intervene in proceedings covering Pan American World Airways proposal to acquire 120,000 shares of Philippine Air Lines stock.**

William Flynn, The Boston Globe: "Flying in the Boeing 707 is more than a means of travelling from here to there in an unbelievably short time though the distance is thousands of miles. Seven-Oh-Seven flight is winged luxury, comfort—with a complete sense of security—in a peaceful void of blue high above the earth."

Walton and Richard Tregaskis, author team: "Flying in the 707 isn't like flying through air any more. It's as if you were moving through something more nearly solid, like water—as in a submarine, the water holding you firmly and smoothly. It's as if you were held steadily on a track, not just in air. You feel secure and steady, despite the fighter-like performance."

Albert D. Hughes, The Christian Science Monitor: "If the reaction of this and other reporters aboard the flight may be taken as a guide, jet travel will be popular with the public. High-speed flight, moreover, is a pleasant sensation marked with smoothness, cabin quiet and lack of vibration, notably different from contemporary aircraft."

Lucia Lewis, Chicago Daily News: "Taking off in a Boeing 707 is a dream-like thing. No roar of engines, vibration, air pressure changes. The swift climb to 35,000 feet is effortless. You shoot along like an arrow, yet chat in complete quiet. This is utterly restful travel—a feature as sensational as the tremendous speed of the Boeing 707."

The reports above are a preview of what *you'll* experience when you fly in the superb Boeing 707 jetliner. They are by five of the writers who earlier this year flew coast to coast—in 3 hours, 48 minutes—in America's *first* jetliner.

These airlines already have ordered 707s: AIR FRANCE • AIR INDIA • AMERICAN • B.O.A.C. • BRANIFF CONTINENTAL • CUBANA • LUFTHANSA • PAN AMERICAN • QANTAS • SABENA • TWA • VARIG

BOEING 707

Airline Income & Expenses—August 1957

(In Dollars)

	Passenger Revenue	Mail Revenue	Express Revenue	Freight Revenue	Total Operating Revenue	Total Operating Expenses	Total Operating Income (before taxes)
DOMESTIC TRUNK							
American	$23,868,707	$536,833	$283,970	$1,535,138	$26,600,912	$24,522,364	$2,078,548
Braniff	4,418,926	106,340	46,784	124,792	4,799,268	4,228,089	513,559
Capital	8,244,481	181,384	89,601	147,147	8,778,577	8,492,647	285,390
Continental	2,132,876	44,818	15,741	56,332	2,303,884	2,077,553	266,331
Delta‡	5,981,979	130,340	78,582	190,860	6,396,809	6,254,098	342,711
Eastern	18,226,450	312,206	683,207†	.....	19,345,005	18,581,476	742,865
National‡	3,729,109	81,652	18,424	126,056	4,143,651	4,042,285	101,366
Northeast*	.....	.....	.....	.....	.....	.....	.....
Northwest	5,146,459	124,247	379,421†	.....	5,686,287	4,778,149	908,038
Trans World	18,422,797	309,698	896,883†	.....	19,717,059	17,775,624	2,398,276
United	24,627,440	762,567	288,607	1,080,936	26,909,340	22,823,634	4,085,706
Western	3,950,842	83,462	31,000	81,585	4,224,313	3,310,170	853,017
INTERNATIONAL							
American	489,293	5,280	154	59,181	581,231	486,641	94,590
Braniff	685,088	10,517	.....	31,891	779,862	730,640	38,777
Caribbean-Atlantic	164,513	1,880	5,369†	.....	184,134	149,870	34,211
Delta	394,796	4,708	.....	13,490	641,885	488,747	153,108
Eastern	1,760,652	32,439	58,015†	.....	1,820,362	1,582,828	335,383
National‡	.....	.....	.....	.....	.....	.....	.....
Northwest	1,951,918	478,978	290,246†	.....	2,857,787	2,351,381	506,406
Pan American	.....	.....	.....	.....	.....	.....	.....
Alaska	556,000	21,000	71,000†	.....	697,000	714,000	—17,000
Atlantic	12,055,000	557,000	832,000†	.....	14,192,000	10,703,000	3,058,000
Latin America	6,804,000	183,000	1,209,000†	.....	8,741,000	8,362,000	660,000
Pacific	5,875,000	410,000	614,000†	.....	7,923,000	6,283,000	1,645,000
Panagra	1,298,000	39,000	.....	162,000	1,782,000	1,670,000	129,000
Trans World	6,938,874	411,617	407,164†	.....	7,980,158	6,840,810	1,064,608
United	1,728,099	65,199	.....	16,833	1,818,765	1,159,183	659,182
LOCAL SERVICE							
Allegheny	562,571	8,035	9,137	11,985	772,216	741,079	31,137
Bonanza	174,617	2,601	1,258	3,497	305,187	315,536	—10,349
Central	144,892	3,712	834	5,129	369,247	357,548	11,699
Frontier	350,541	180,914	3,000	25,012	576,146	522,040	51,455
Lake Central	154,101	3,976	8,509†	.....	358,560	305,149	53,410
Mohawk*	.....	.....	.....	.....	.....	.....	.....
North Central	796,654	163,048	14,962	.....	996,477	986,211	10,572
Ozark	411,164	236,569	5,935	12,760	681,796	665,513	10,323
Piedmont	550,160	9,305	4,710	8,598	808,167	695,331	112,776
Southern	216,765	8,099	4,752	.....	405,243	386,817	18,426
Southwest*	.....	.....	.....	.....	.....	.....	.....
Trans-Texas	296,400	9,754	3,934	12,314	580,976	559,455	21,525
West-Coast	246,761	4,428	1,884	4,352	388,041	378,065	9,978
HAWAIIAN							
Hawaiian	634,598	2,871	53,000†	.....	723,899	566,201	148,951
Trans-Pacific	300,501	1,076	13,160†	.....	324,004	259,648	64,356
CARGO LINES							
Aerovias Sud-Americana	.....	.....	.....	.....	171,538	166,386	5,151
Flying Tiger	.....	6,890	737,855†	.....	3,207,692	2,988,620	219,072
Riddle*	.....	.....	.....	.....	.....	.....	.....
Seaboard Western*	.....	.....	.....	.....	.....	.....	.....
Slick*	.....	.....	.....	.....	.....	.....	.....
HELICOPTER							
Chicago Helicopter	35,098	86,366	.....	.....	121,541	140,973	19,432
Los Angeles Airways	19,603	10,737	7,153	.....	117,176	105,612	11,088
New York Airways	46,947	5,197	1,589	2,914	301,908	214,069	—12,161
ALASKAN							
Alaska Airlines	188,655	49,180	1,039	68,052	518,188	506,766	11,421
Alaska Coastal	96,740	8,928	.....	9,681	169,190	139,352	33,839
Cordova*	.....	.....	.....	.....	.....	.....	.....
Ellis	70,475	5,353	.....	6,868	119,613	90,110	29,503
Pacific Northern	885,964	63,921	99,244†	.....	1,144,270	936,759	207,691

* Not available. † Property figure. ‡ System figure.

Compiled by Aviation Week from Airline Reports to the Civil Aeronautics Board.

More about Bristol's "Whispering Giant": world's largest, fastest, quietest, jet-prop airliner

INTER-CITY.....

Inter-city or trans-polar...only the Britannia is a money-maker on such a vast variety of routes

HERE is an airliner ideally suited to almost any stage-length . . . short or medium or long. Here is the only airliner that makes money in so many different ways . . . on inter-city, trans-continental, or even the longest trans-oceanic flights.

This is an airliner that outperforms all other passenger aircraft in service . . . the new Bristol Britannia . . . world's largest, fastest, quietest, jet-prop transport. Her record shows her to be the most versatile airliner ever to fly. She has no noise, runway or traffic-control problems. Her remarkable flexibility allows her to use existing traffic patterns and runways almost anywhere in the world.

Operators have already chosen Britannias for an amazing variety of stage-lengths, from short 200-mile inter-city routes to long 4,500-mile trans-polar flights.

. TRANS-POLAR

Britannias will be flown between Mexico City—New York by Aeronaves De Mexico; between Havana—New York by Cubana de Aviacion; and between New York—Washington and New York—Miami by Northeast. The same type of aircraft will be flown nonstop across the Atlantic by BOAC and El Al, and on trans-polar and trans-Pacific routes by Canadian Pacific.

Powered by four 4120 h.p. Bristol Proteus turboprop engines, the "Whispering Giant" cruises at 400 m.p.h., carries up to 133 passengers and cuts operating expenses to a new low.

World-wide recognition and demand:

Britannias are in service on BOAC routes spanning four continents and have been ordered by Aeronaves De Mexico, Canadian Pacific, Cubana De Aviacion, El Al Israel Airlines, Hunting-Clan Air Transport, Northeast Airlines, the Royal Air Force and the British Ministry of Supply.

BRISTOL

Britannia

Bristol Aircraft Limited • England

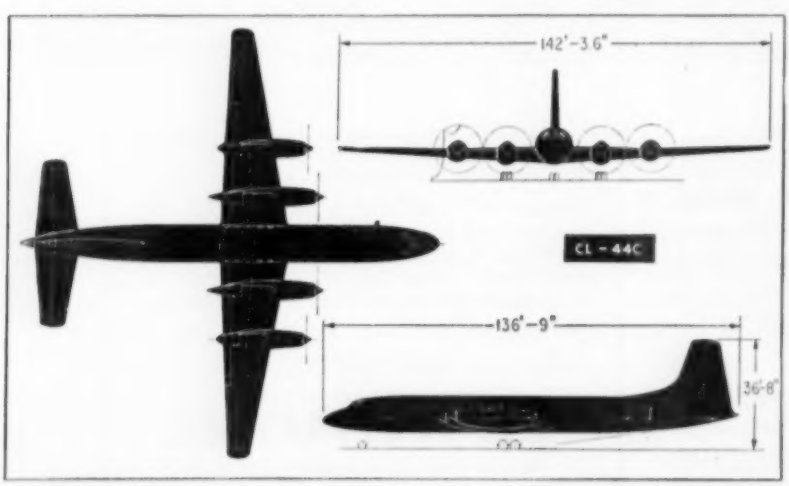
CANADAIR has a licensing agreement with Bristol covering sale of this proposed turboprop which retains Britannia fuselage.

CL-44, New Short Design Show Similarity

New York—Design proposal for a new turboprop heavy duty freighter utilizing Bristol Britannia components was disclosed by Short Bros. and Harland at the same time as Canadair Ltd. disclosed specifications for its CL-44 project, which also is based on the Britannia.

Canadair, which is to build the Bristol Orion powered CL-44 for the Royal Canadian Air Force, has a licensing agreement with Bristol covering sale of the transport/cargo aircraft and its related project, the CL-28 anti-submarine patrol plane. Canadair said it has extensive sales rights for the freighter version.

The Short Bros. proposal, made to the British Ministry of Supply, would use the Bristol Orion engine, as the CL-44 will. Unlike the CL-44, it would have a high wing, but the wing design itself would be the same as the Britannia. Other Britannia components retained would be the complete flight deck, whole tail assembly and control system and the undercarriage.



CANADAIR is grooming its CL-44 as a contender for the low cost, long haul market.

Canadair Informed

That Short Bros. had a transport project under study was known to Canadair, which has been informed by Bristol.

Canadair said that the Short Bros. project is a totally different aircraft and does not overlap the CL-44 in function.

Bristol also said there is no conflict between the aircraft. The CL-44 is a transport aircraft and freight carriage is purely incidental, Bristol said. It retains the Britannia fuselage. The Short Bros. project is specifically designed for heavy freight movement, Bristol said, having a completely redesigned fuselage and aimed for medium range freight markets first and later for the transatlantic field.

Short's chief project designer, S. H. Robertson, reached at Belfast, Ireland, by AVIATION WEEK, said fuselage will

be half as big again as the Britannia's.

Designed on fail safe principles, the 17 ft.-in.-diameter fuselage will have a very low level floor and a large rear ramp. A notable feature of the fuselage is the provision for separate pressure, temperature and humidity control between the flight deck and the freight hold.

Gross weight of the Short development will not exceed that of the Britannia but its payload over 1,000 mi. should reach 30 tons. "It would accommodate 200 troops from a quick look at the specification," said Robertson, "but our primary objective is a heavy freighter."

Wing Changes

Only minor wing modifications are involved as a result of the higher landing weight. The inner portions of the wings need slight thickening but this will not call for any jigging and tooling changes. The Britannia undercarriage and geometry remains completely unchanged. "But," Roberston said, "we shall mount it from the bottom corners of the fuselage and retract into fuselage blisters."

A thin wing version using Orion engines with gross weight stretched to 220,000 lb. is contemplated which would put the cruising speed up to 400 kt. and the payload to 30 tons over 3,000 mi.

In discussing this new development philosophy, Robertson stated that Short "feels future development of the Britannia will depend on a thinner wing and fully developed Orion engines, but it is too expensive to go straight to it." The company hopes to do some quick business, open up a market with the Britannia wing version—operating costs would be very much down from Britannia rates—so that it can soon afford to introduce the thin wing version.

"In any event," said Robertson, "the freighter version being slightly slower due to its high drag fuselage is better suited to the Britannia wing." Its optimum cruising speed would be down to 300-350 kt. Higher cruising speeds would mean the wing would get into critical Mach number area. Robertson reckoned it was well known the Britannia was already suffering drag penalties due to its proximity to critical Mach number.

Thin Wing

Even in the thin winged version the undercarriage geometry and most of the components will be retained. "All we need is slightly bigger tires, and thicker walls for the hydraulic elements," Robertson said. The fuselage will be designed "from the word go" to meet the final stretched thin wing gross weight specification loading.

Robertson disclosed that since the company has been doing some "extensive integral wing investigations at Belfast its new thin wing will be a machined integral structure."

The Orion engines have been designed to plug into the Britannia wing. "In its final form with Orion engines and a thin wing we reckon to be able to ferry 40-60,000 lb. of freight across the Atlantic at 400 kt." Robertson estimated..

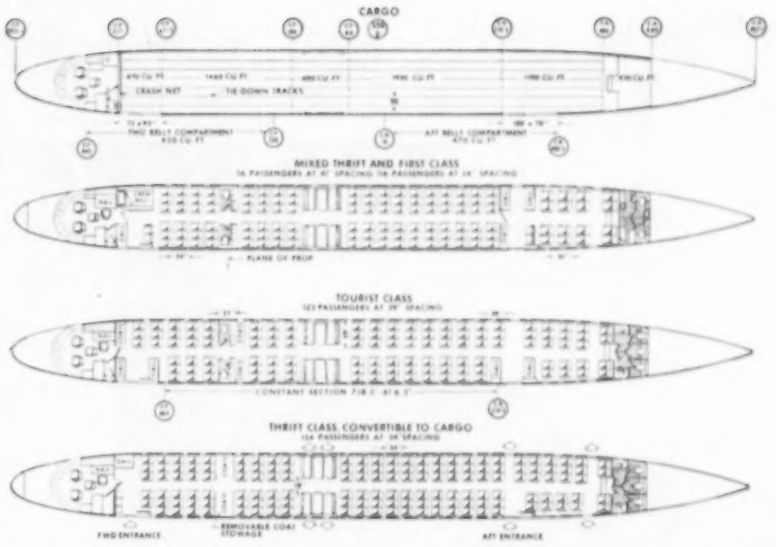
Canadair estimates that its transport will be able to carry approximately 70,000 lb. of cargo across the Atlantic at a cruise speed of about 400 mph. and at a direct operating cost of 4.5-5 cents a ton-mile. In the passenger version, the aircraft could take a 154 passenger thrift class load nonstop New York to London at a direct operating cost of approximately 1 cent a seat-mile, including depreciation.

Environmental Control

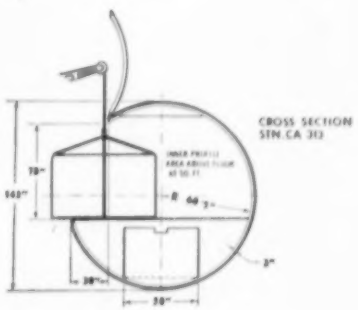
Feature of the Short freighter specifications will be the provision for independent pressure, temperature and humidity control of the flight deck and freight hold.

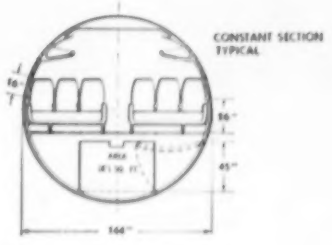
Robertson cited numerous advantages of this system. The transportation of rhesus monkeys is now big business and in present aircraft "crews are virtually social outcasts because of the smell." Engine bleed air economies can be made when transporting steel products and with such items "switching to zero humidity is very desirable too," Robertson said. Best conditions—they can be critical—for transporting fruit, vegetables and meat can be obtained "without freezing, drying or cooking the crew."

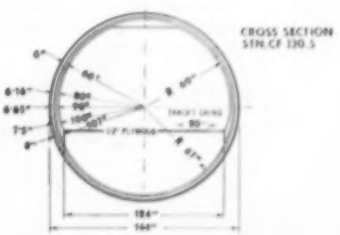
Maximum pressure was same as for the Britannia but the company has not overlooked the possibility of even higher local pressures for the transportation of items such as unfrozen meat and thereby prevent it from bleeding. Night stops



ALL-CARGO and convertible versions of CL-44 have two large loading doors, maximum size 6½ x 10 ft. Strong floor with tracks can support heaviest loads. Total gross volume for cargo will be 7,320 cu. ft. Passenger versions will seat up to 154 in new "thrift" class with 34-in. spacing. Projected seat-mile cost is 1 cent, lower than current international rates.







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THE TEST OF TIME!

At work for more than 2,500,000 hours

- **in the desert**
- **in the mountains**
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- **in 52 countries of the world**

. . Bell helicopters have proved their dependability. And what better test of dependability can there be? Certainly no man-made test can simulate the operating experience of the Bell H-13. No other helicopter has done what the Bell has done.

Because it's the actual "performance" — not "rehearsals" — that stands in the records, the Bell H-13 proudly points to its own . . more flight hours, lower maintenance costs, more dependability.. yesterday, today AND TOMORROW!

BELL H-13H FEATURES:

1. Longest approved overhaul period.
2. Interchangeable metal blades.
3. Cyclic boost (power steering) that incorporates latest Bell designed and developed lock and load valves.
4. Synchronized elevator that permits greatest range of cockpit loading without battery or ballast shift.

DERATED ENGINE PROVIDES

1. Improved hot weather and altitude performance.
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4. Reserve power for emergencies.
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are another problem with perishable goods and "the company is looking to the need for an auxiliary power unit driving a freon refrigeration plant with which to maintain air conditions."

Freight Area

Length of freight hold will be 80 ft. It will give 12 ft. square freightage. Short emphasized that a much smaller break-even order than with the airliner will be possible due to high percentage of Britannia components used. Also production can begin quickly, the company said.

Canadair, in revealing final configuration data of the aircraft (military transport version), said that in its passenger configuration it will be known as the Canadair Liner; as a cargo ship, the Canadair Freighter. All versions, both the proposed civil and military, will be powered by the Orion engine, which is rated at 5,150 eshp.

The aircraft will be "Americanized" in regard to materials, standards, accessories and systems.

Length of the transports will now be almost 137 ft.—or 23 ft. longer than the CL-28, which up to the present is the largest plane ever built in Canada. This makes available a total gross volume of 7,320 cu. ft. for cargo, or space for up to 154 passengers in the new " thrift" class seating arrangements with 34 in. spacing.

Various other arrangements, reflecting different degrees of comfort from de luxe to normal tourist or mixed class, as well as combinations with cargo, can be provided.

Fuel Load

Its fuel capacity of 10,036 imperial gallons makes possible a maximum range of 5,000 statute-miles with a substantial payload and normal fuel reserves, providing non-stop transatlantic and transpacific service in either direction at all times of the year. Maximum speed is 445 mph.

To accommodate these payloads, Canadair estimates the following weights:

- **Maximum takeoff** gross weight—205,600 lb.
- **Maximum landing** gross weight—160,000 lb.
- **Maximum zero fuel** weight—155,000 lb.
- **Operating weight** empty, cargo—86,121 lb.
- **Operating weight** empty, passenger—101,194 lb.

Canadair also is grooming its aircraft as a contender for the low cost, long haul market. It compares the CL-44 projected 4.5-5 cents a ton-mile cargo cost with a current figure of 10.5 cents a ton-mile, and the projected passenger seat-mile cost of 1 cent to current international tourist costs of 1.8 cents including depreciation, of 1.4 cents excluding depreciation.

In the all-cargo and convertible versions, the Canadair freighter has two large loading doors, maximum size 6½ x 10 ft. and a strong floor with tracks which are capable of supporting the heaviest cargo load. Special attention is being given to the problem of quick and easy loading, and various schemes of "palletized loading" will be available.

The CL-44 program calls for delivery of the first aircraft to the RCAF late in 1959. Commercial versions could be delivered from the beginning of 1960.

Turboprop Convair 340 Ready for CAA Testing

Civil Aeronautics Administration certification flight tests of Convair 340 powered by Napier Eland engines will start in mid-November at Pac Aero Engineering Corp., Santa Monica. Under amended regulations, conversion will be a modification, not a new design.

Following certification of the conversion, Pac Aero will convert three 340s owned by Real Aerovias Nacional to Eland turboprop engines. Pac Aero also will convert a Napier 440 to Eland and obtain certification under the contracts, which total approximately $1 million.

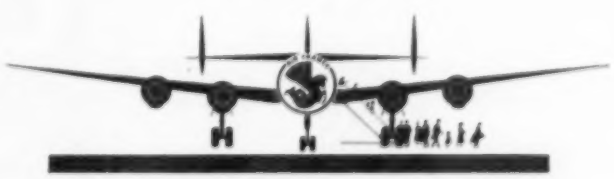
The Men Who Are Air France

No. 10 OF A SERIES

CAPTAIN GEORGES LIBERT

A SENIOR AIR FRANCE CAPTAIN

In every country you find men like this—men whose natural home is the sky. Captain Libert has been a pilot for over 22 years, totaling nearly 15,000 hours of flight. His peacetime and wartime record is truly impressive, as attested to by the numerous decorations bestowed on him by France and other countries. His record is typical of the men who man the planes of Air France, the airline that has been serving the peoples of 73 countries for over thirty-eight years.



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CONVAIR'S NEW 880
air-conditioned by HAMILTON STANDARD
incorporating COLE HEATERS

Illustration courtesy of Convair Division, General Dynamics Corporation

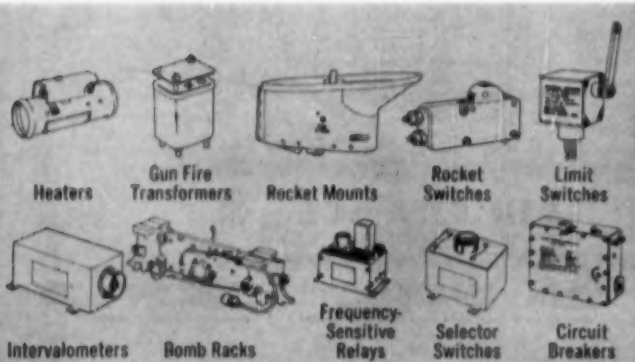
15 K.W. Duct Heater, engineered and built by Cole Electric Co. for Hamilton Standard's air-conditioning system in the new Convair 880.

It's mighty cold at 40,000 feet, yet passengers in Convair's great new 880 jet airliner will relax in complete comfort, thanks to a highly-efficient air-conditioning system by Hamilton Standard Division of United Aircraft Corporation.

Electric Duct Heaters for the system are engineered and built by Cole Electric Co., again demonstrating that major aircraft manufacturers often depend on smaller companies to develop and produce dependable components.

You, too, can depend on the engineering skill and precision production facilities of Cole Electric Co.

Write or phone regarding your requirements.



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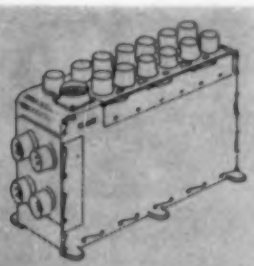


Miniaturized Electrical Substation for ground-power check-off of guided missiles.

Soviet Progress Spurs Machining Study

By Irving Stone

Los Angeles—Importance of producibility methods research that Lockheed Aircraft Corp. is conducting to establish critical velocities for cutting common aircraft materials is underscored by progress the Russians have made in this field.

Discussing producibility aspects of advanced aircraft structures, Lockheed engineer Alfred H. Petersen told the third annual Contour Machining Conference here that the Russians have apparently far outstripped the U.S. in reducing theory of critical machining velocities to practice. Phenomenal speeds and feeds—far beyond those used in this country in normal practice—have been reported through qualified sources, he claimed.

"Eye witnesses say that the chips they have been producing are pyrophoric (igniting spontaneously) and disappear into thin air, with the workpiece assuming the color of a rainbow and with tool itself remaining cool."

The transition to stronger and tougher alloys than are being used today is going to be slow process where airframes are concerned and for the next five years, at least, will not be completed, Petersen declared. But in the field of machining, where great strides have already been made in shaping and automatic controls during the past few years, a still greater effort must be expended in research and development and into faster and more efficient machines, tools and techniques, he claimed.

Theory of Velocities

In his discussion of cutting speed, Petersen referred to the critical machining velocities developed by Dr. C. Salomon, German researcher. Salomon's work, he said, has been further substantiated in part, by a theory of Dr. Theodore von Karman which, in effect, holds that a force which would create fracture at low speed, if applied fast enough, will cause deformation of the materials instead of fracture, Petersen explained.

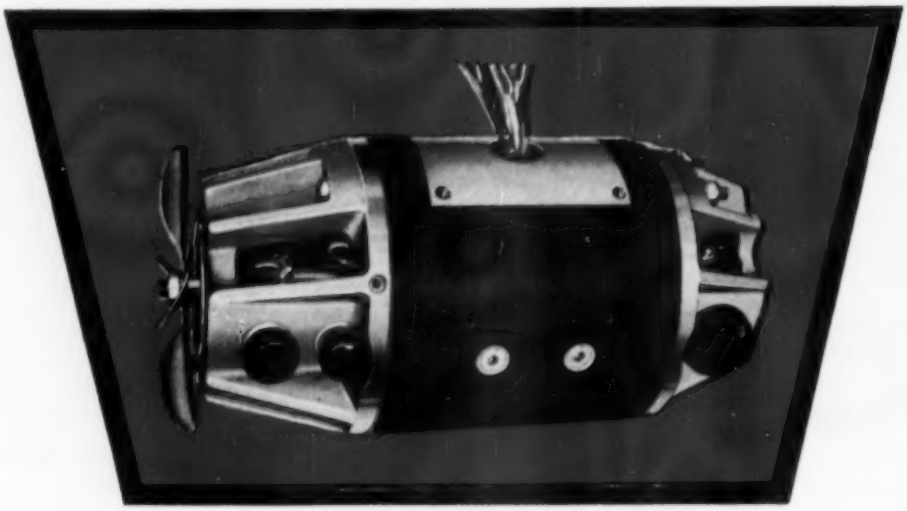
In discussing Salomon's and von Karman's theories with Lockheed scientists and research personnel, good agreement was found that these theories are sound, although some modifications may be necessary, Petersen said. As a result, Lockheed has initiated a series of tests intended to get some rough idea as to what happens to the workpiece and tools at very high velocities. First problem was to achieve desired velocities, and for this Lockheed adapted a rifle firing technique. Rifle used was a Mauser with a special smooth barrel bored to accept a .300-in.-dia. slug. On the end of the barrel, a tool holder was mounted. Cartridge cases were loaded with various grades and quantities of powders. Slugs, designed to fit the cases, were 2 in. long, made of AISI

H-34 Carries Varied Armament

Army H-34 Choctaw helicopter, parked at Sikorsky Aircraft plant at Bridgeport, Conn., carries a wide range of armament. Included are two .20 mm. cannon, one on each side of the cockpit; three .50 caliber machine guns, one on the right of the cockpit and two on the left; six .30 caliber machine guns (between fuselage and rocket tubes); forty 2.75 in. rockets, 20 to a side, and two 5-in. anti-tank, anti-submarine rockets. Fittings were designed, made and installed by Sikorsky.

Case History from the files of the Wincharger Corporation

problem: PROVIDE FAULTLESS POWER TO GUIDE A FAMOUS MISSILE



All the engineering ingenuity built into a famous missile was threatened by a reliability problem in the guidance power supply.

Acceleration and vibration had produced shock that "unsettled" electronic components on which the missile relied for zeroing unerringly onto the target. Wincharger's Research and Engineering Group, well-known in the industry for problem-solving resourcefulness, was asked to tackle the power supply problem.

After extensive experimentation the answer came through re-design of a single sub-assembly, providing a new and heavier shaft, larger bearings, and strengthening of the end brackets.

This missile has since gone into production, to make headline news across the world, with the required FAULTLESS power provided to guide its flight.

If your work requires special purpose power supplies, alternators, inverters, or dynamotors, bring your problem to Wincharger's Research and Development Group. Their extensive experience in solving problems in all phases of these fields is your best assurance of a workable solution.

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CONVERTER BY WINCHARGER

Specifications

Input — Nominal 26.5 volts D.C.

Output No. 1 — 135 volts D.C. at 400 mils with 20 ohm choke

Output No. 2 — 280 volts D.C. at 150 mils without choke

Unfiltered Ripple Maximum — 10%

Duty — Continuous

Temperature Range — Minus 65° C to plus 125° C
Note: Must operate for 6 minutes at 246° C

R.P.M. — 6,000

Altitude — 80,000 feet

Meets all requirements military specifications MIL - D-24A

SPECIALISTS IN ELECTRONIC AND ROTARY ELECTRICAL DESIGN AND MANUFACTURE

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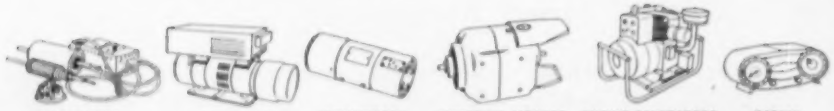


ALTERNATORS INVERTERS DYNAMOTORS UNIVERSAL MOTORS ENGINE-GENERATORS RADIOS

4340 steel heat-treated to 280,000 psi. ultimate tensile strength.

First firings were made across single point tools ground to 90 deg. included angle, and in various alloys and carbides. Initial firings were chronographed and muzzle velocities averaging 2,200 fps.–132,000 sfm.–were recorded. Second series were run with a flat-nosed tool, and surface feet per minute was increased to 162,000.

Cutting Observed

In both series of tests, definite cutting action was observed without tool failure, except for a carbide tip in the first test. Cuts were smooth, second group of slugs measuring 20 micro-inches. Increase in hardness of 1 to 4 points Rockwell C was measured in the slugs to a maximum depth of .010 in. below the machined surface, but otherwise no effects on structure or strength were measurable.

"To date, we have not been able to observe the resultant chip. Further, more elaborate tests are planned which will be fully instrumented so that all variables can be studied", Petersen declared. Chip produced in tests may be pyrophoric, he told AVIATION WEEK.

From these tests Lockheed expects to establish critical velocities for cutting all aircraft materials.

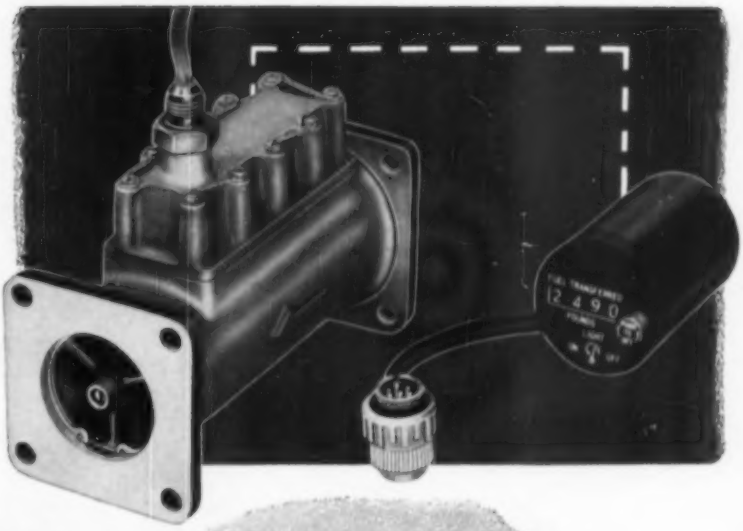
Commenting on how critical velocity theories can be reduced to practice, Petersen said: "Frankly, this is not known today. The initial effort must be to establish the validity of the theories and then the machine tool builders must design tools with the necessary velocity and rigidity to reach the target. When it is realized that the power requirements fall off in inverse proportion to the speed of cutting, then the idea becomes more rational. It is believed that present work in dampening devices and the causes of acoustical vibrations may contribute something worthwhile. Thus, for linear and peripheral machining where access and cutter size are not limited, it's a job of development."

Producibility Barrier

Petersen emphasized that pocket and contour milling of hard alloys at these speeds may not be feasible. Spar, beam and rib with dozens of small pockets and small fillets throughout the piece will constitute a serious producibility barrier, he pointed out.

"One must have the utmost respect for the airframe designer and his wonderful ability for getting the last ounce of weight out of a structure and for chasing loads through the frame across sometimes tortuous paths. But metallurgist, production engineer and tool designer must work much more closely together than has been the custom."

It would seem that the designer must



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BUDDY-SYSTEM REFUELING

...No "Black Boxes" Needed

Buddy-system inflight refueling means greatly increased range and striking ability for carrier-based aircraft. The Revere Flowmeter System, used in this new method of mid-air refueling and now being produced for two Navy prime contractors, *totalizes flow accurately and dependably without the use of "black boxes" or vacuum tubes.*

The output signal of the transmitter, shown above, is fed directly into the electrical counter, eliminating the need for external electronic amplification.

Various impulse-flow ratios, flow rates to suit your totalizing applications. Rate of flow indication also available.

REVERE CORPORATION OF AMERICA
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HERE AT LAST – THE IDEAL FIELD ATTACHABLE FITTING:

Triple-locked to hose – cannot blow off.
Dynamically sealed – not once, but twice – cannot leak.
Tamper-proof – cannot be loosened accidentally or by vibration.

WILL PERFORM AS DEPENDABLY AS IF FACTORY ASSEMBLED

by trained mechanic under closest supervision – yet
Easily assembled – flared skirt on socket protects hose and hands.
Needs no special skills – no torque wrench required.
Foolproof – parts fit only one way – the right way.

AND IT IS TRULY REUSABLE AGAIN AND AGAIN

Hardened parts keep extra safety factors intact.
Lines made with Seal-Lock Fittings which have been disassembled and reassembled many times still function as well as originally.

ANOTHER PRODUCT OF RESISTOFLEX INGENUITY,

to the standards of Resistoflex Reliability,
for your safety and that of your customers!

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stay with internal structures of aluminum alloys with which he is so familiar for many years to come simply because weight-strength ratios will dictate this and, what's more important, because our whole airframe economy is based on our knowledge of how to design and fabricate aluminum structures. The temperature-resistant alloys need much improvement not only from a strength, corrosion and ductility standpoint, but they must be capable of being processed so as to afford the maximum fabricability. The production and tool engineers have the joint responsibility of keeping the design and the methods of producing it advancing in equal strides.

ADC Fighter Pilots Will Train for SAC

Air Force need for more pilots with multi-engine training will result in reassignment of 109 Air Defense Command fighter pilots to B-47 training courses for subsequent assignment to Strategic Air Command bases.

Decision was made because changes in USAF organization have reduced requirements for fighter pilots while buildup of the jet bomber course has increased the need for pilots with multi-engine training. Limitations on fighter pilot age was another factor—one that establishes a requirement for a pilot rotation program.

Cutbacks to Result In Drop at Lockheed

Employment will be cut at Lockheed Aircraft Corp's California Division from about 29,000 to about 24,000 workers by the end of 1957 as a result of military procurement economies.

Burt C. Monesmith, vice president and general manager of the California Division, said that companywide, Lockheed's position is bolstered by a sharply rising level of business and employment at the Missile Systems Division and prospects of sustained business at the Georgia Division and Lockheed Aircraft Service that will bring only slight declines in employment.

Lockheed's total backlog of firm airline and military business presently approximates $1,242,000,000, with certain additional contracts nearing completion.

"New sales of airliners could improve the employment outlook within the California Division next year," Monesmith said, "but prospective new military orders would have little effect until 1959 because of long tooling and preparation time necessary on all new models."

Numerous developments could alter any forecasts made now. But based

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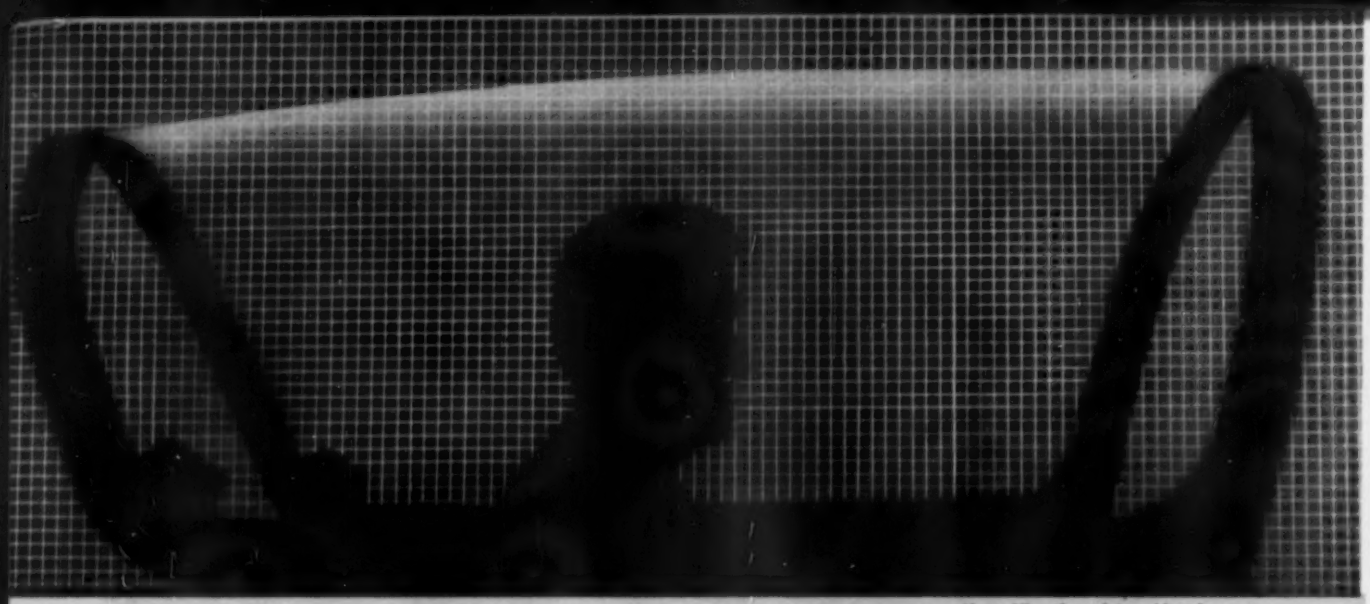
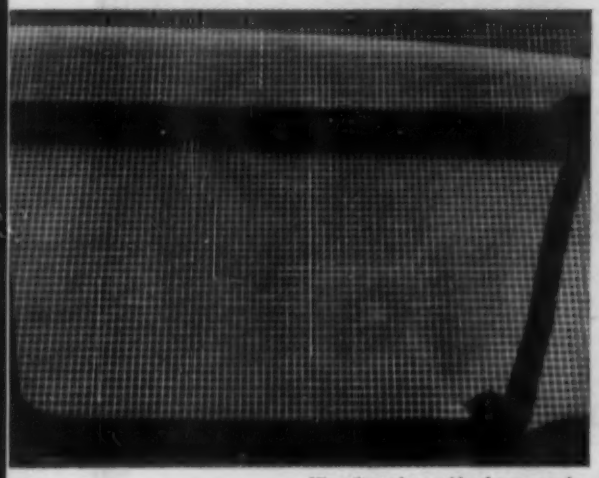


Republic F-105 canopy in front of standard test acceptance grid. Any defect in optics would result in distortion of the grid lines. Note that the Swedlow stretched acrylic Republic F-105 canopy, in a compound contour shape is virtually distortion-free.

Above: View through two sides of canopy.

NOW! SWEDLOW "STRETCHED ACRYLICS" PROVIDE GOOD OPTICS ON REPUBLIC F-105



View through one side of canopy only.

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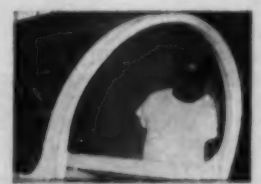
Republic's F-105 Thunderchief, newest supersonic fighter-bomber developed to deliver nuclear weapons and heavier loads of conventional bombs and rockets at extremely high speeds over long ranges, feature Swedlow-produced stretched acrylic canopies and windshields.

The F-105 encompasses such outstanding design features as the long, cylindrical fuselage, the short, very thin swept-back wings, the needle nose, and the ventral fin on the bottom of the aft fuselage near the tail. Design based on Area Rule. Wing span, over 30 ft. Length, over 60 ft. Powered by Pratt & Whitney J-75, 15,000 lb-thrust class, turbo-jet engine plus afterburner. Speed—supersonic.



Careful, technically accurate efforts go into the fabrication of each Swedlow stretched acrylic part. Republic F-105 canopy being fabricated in Swedlow plant.

Windshield on Republic's F-105, as on many other fighters and bombers, is also of Swedlow stretched acrylic... produced on a "production basis"... with good optics and contour.

Los Angeles, California

Youngstown, Ohio

Please refer to Dept. 10

Swedlow
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solely on current business and not allowing for the probability that further commercial sales efforts or other events might alter the work load, our forecasts indicate a possible year-end 1958 work force of around 17,000 at Burbank, Palmdale and Maywood plants—somewhat above the size of the entire Lockheed organization at the start of the Korean buildup, Monesmith said.

Army's Aviation Funds Ample for Essentials

Dallas—Army aviation, despite recent Defense Department cutbacks, has enough money for its essential programs, according to Donald Thompson, technical director of Army Aviation Research and Development in the Office of Chief of Transportation.

These essential programs—including Bell's H-40 project—will be funded completely, Thompson told a meeting of the Southwest Region of the American Helicopter Society.

Thompson flew the H-40 at Bell's Ft. Worth plant, and he had high praise for the new turbine powered helicopter. He told his audience, composed largely of Bell engineers, "We are defending the H-40 program at all costs," and "we would have to be completely broke" to drop it.

Engineers working on designs for the Army will be able to draw on Army experience when a new Army Aircraft Designer's Guide is published, Thompson said. Work on the guide is under way at Ft. Eustis, Va. It is expected to be ready next spring.

The guide will put in print what the Army has learned in operating its various aircraft. It will include features that experience shows Army aircraft must have, and it also will describe field fixes and engineering changes made in aircraft the Army is now flying.

Thompson explained the Army's procurement philosophy in answer to a question of whether Army has had better luck ordering aircraft to specifications or buying them off the shelf. He said the general feeling is that better results are obtained from giving specifications and money to the engineers to build an airplane. This method gives the Army the aircraft it wants, and Thompson said the H-40 is a good example of this approach.

Engines for Atlas ICBM Enter Production Phase

Neosho, Mo., plant of North American Aviation, Inc.'s Rocketdyne Division is beginning production of engines for the Atlas intercontinental ballistic missile. Neosho plant has been in build-up production of the developmental engine since February.

Another New PAYMOVER

with Power-shift Transmission

Flying Tiger Line, oldest and largest certified air-freight carrier in the U. S. A. chooses this advanced design "PAYMOVER" tractor to handle its fleet of new super freighters.

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The new T-150 tractor travels up to 22 mph., turns in a radius of 12 ft. and is only 4½ feet high so it can easily maneuver around planes. Optional equipment includes 24 v. electric system, diesel or LPG power, 2 man cab, 2-way radio units and easily attached sweeper, snow plow and winch attachments. Any Hough Distributor has more information on the Model T-150 or smaller "PAYMOVER" tractors. Contact him or write: The Frank G. Hough Co., 976 Sunnyside Ave., Libertyville, Ill.

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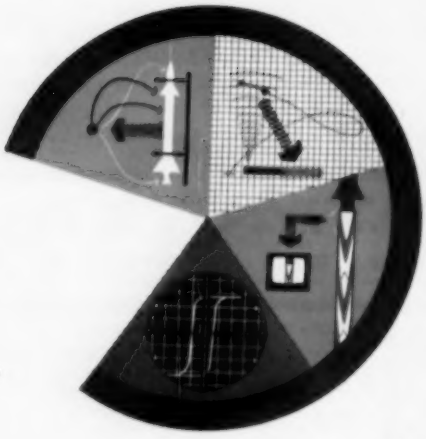

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81-57

Utilization of ICBM as Propaganda Weapon Urged as Deterrent to War

Ft. Worth—Greater use of the intercontinental ballistic missile as a propaganda weapon in deterring wars was urged here last week by James R. Dempsey, manager of Convair's Astronautics Division.

Criticizing military security policy which obscures information on the ICBM program, Dempsey said he hopes this tight security policy will be relaxed somewhat in the next few weeks.

Dempsey said he considers Convair's Atlas and Martin's Titan directly competitive in the intercontinental ballistic missile field, but said there may be a place for both of them in the U. S. weapons arsenal. Convair is now working on Atlas at its San Diego plant, but Dempsey said the missile also could be produced at the Ft. Worth plant if USAF orders warrant a move.

Development Philosophy

Discussing missile development philosophy at a meeting of the Convair Management Club, Dempsey said management must be prepared to accept failures during the development cycle. He said Convair has been lucky thus far because there have been "no random failures or idiot failures" in its ICBM program.

Dempsey pointed out that, when the Germans were developing the V-2, they went ahead and built 6,000 of them in a two-year period while development was still under way. Germans fired about 2,000 V-2s before the missile was fully developed.

As missiles have become more complex and expensive, Dempsey said, we can no longer afford to take this approach. He outlined a testing approach which involves thorough testing at the earliest possible stage to eliminate as much flight test as possible.

Convair does not try to do anything in flight test that can be done in static test, Dempsey said. He observed that much can be learned about operating time, systems interaction and other items from static test, although there are no aerodynamic effects and vibration effects are different from actual flight conditions.

Test Procedure

In the same way, nothing is tried in static test that can be done in the laboratory.

Here the cycle begins with testing of components as small as resistors and condensers. This technique adds up to a great deal of knowledge before a missile is actually flight tested, Dempsey said.

Since missiles are unmanned, a basic testing problem lies in finding out what goes on during flight test. This requires instrumentation, and Dempsey observed that testing also requires equipment for range safety and self destruction. The missile contains more gear for information and safety than for all the rest of the systems.

Convair official said all this is the price of the missile's lack of capability for repetitive testing. It forces the de-

French MATRA R.510 Air-to-Air Missile

First photo of the actual French MATRA R.510 air-to-air missile shows the weapon mounted for test purposes on a French air force jet two-seater. MATRA can be fired at altitudes between 10,000-48,000 ft. Speed is Mach 2. Missile is now in the pre-production stage. Total equipped weight is 170 kg.

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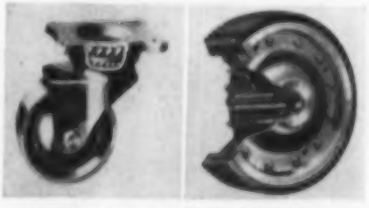

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Depth charge's water plume rose 300 ft., induced low-level cloud to discharge three lightning bolts on partially overcast day. Scientists of Naval Ordnance Laboratory, Silver Spring, Md., were conducting experiments on Chesapeake Bay. Discharges all followed same downward ionized path, struck successively. Depth charge was conventional, and there was no indication of electrical activity in air.

signer to evolve a development philosophy aimed at reducing time and cost and increasing reliability.

Dempsey cited these major factors in missile development:

- **Information and techniques learned** in aircraft development can neither be followed nor discarded without analysis.
- **Facilities pace a program,** and they require early and sustained high level attention. Dempsey said Convair had underestimated this problem.
- **Test planning requires** early attention and detailed planning.
- **Change control** is important to balance engineering's demands for immediate changes and production's resistance to any changes.
- **Proper vendor** selection is important to insure reliability as the program progresses.
- **Management must expect** and accept failure, which is not alarming and is necessary in such a program.

Gen. Boyd Retires

Baltimore, Md.—Maj. Gen. Albert C. Boyd, deputy commander for weapon systems of the Air Research and Development Command and veteran Air Force test pilot, retired last week after 30 years of service.

Gen. Boyd was the first commander of the Air Force Flight Test Center, Edwards AFB, Calif., and later served as commander of the Wright Air Development Center before reporting to ARDC headquarters in 1955.

In 1947, he established a world speed record of 623.5 mph. in an F-80R, returning the record to the U. S. for the first time in 24 years. He was the recipient of the Octave Chanute award of the Institute of Aeronautical Sciences in 1955 and the Air Force Assn.'s Air Power Trophy in 1950. He also has been chosen a fellow of IAS.

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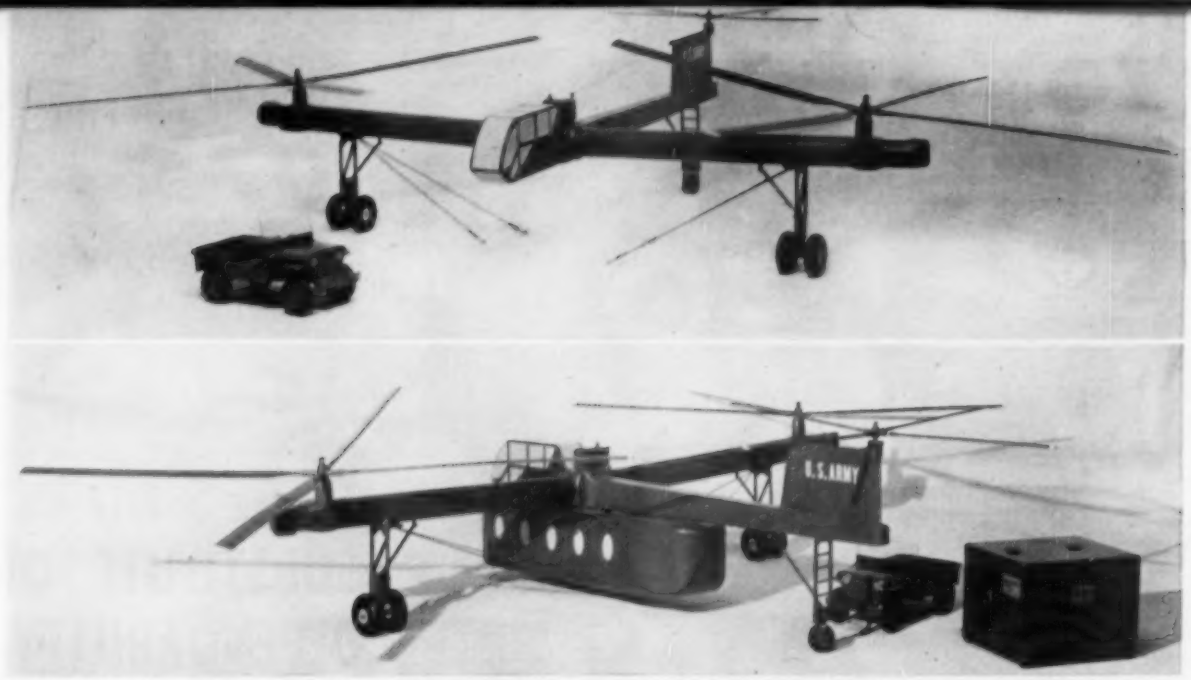


MODEL of unsolicited design proposal for a 12 ton payload flying crane is one of many submitted to the Army. Various loads and types of containers can be carried. Tension loads in the outriggers supporting the main rotors are taken by the cables attached to the payload container. Design is the work of the Bergen Research Engineering Corp. of Teterboro, N. J.

Flying Crane Ideas Submitted to Army

New York—Army's flying crane hopes are currently thwarted by a lack of money, but industry interest in the project is still high. Several companies, large and small, are privately financing design work in anticipation of eventual commercial as well as military interest.

Army's expenditure on the project to date has been largely confined to seven feasibility studies it made to get industry opinion of possible approaches of the problem. If and when the Army gets the money to buy the 8 to 16 ton payload crane that it wants, a design competition will precede the contract award.

Most of the present Army aviation research and development money is being spent on the Grumman AO-1 Mohawk observation plane, and engine development work. Even though there hasn't been enough money to pursue the much desired flying crane, the Army has had the benefit of many unsolicited engineering proposals concerning such an aircraft. Unsolicited work of this type has long been of aid to Army aviation as evidenced by the fact that 30% to 50% of its research and development contracts are let as a result of such proposals. Dollar volume of these contracts is a much lower percentage of the research and development budget but their substantial number helps small business considerably and nourishes an invaluable source of ideas for the Army.

One unsolicited proposal for a flying crane was submitted by Bergen Research Engineering Corp., Teterboro, N. J., a small firm primarily known for its work in transmissions, mechanical drives and high pressure, high temperature valves and switches.

The Bergen design proposal is obviously the product of considerable thought and effort, which is typical of much of the unsolicited work submitted to the Army. Even though the feasibility of such proposals is agreed upon, the cost of developing them into useful hardware is considerable.

Bergen proposal is a three-rotor, gas-turbine powered crane with a 12-ton payload. It calls for use of many parts from helicopters which are operational today. Purpose of such design is to save money and development time. Opinion in the Army is divided, however, on the advisability of this procedure. Opponents of the idea argue that building a new aircraft from old parts would result in a heavy, far from optimum machine. There is also the question of proprietary rights to a conglomerate aircraft.

The Bergen flying crane would have a maximum gross weight of 80,000 lb. and weigh 44,400 lb. empty.

Three widely separated rotors are used because of their inherent stability and elimination of the requirement for rotor synchronization. Three engines are used to increase power failure safety. Two of them are Pratt & Whitney T34 gas turbines of 5,500 hp. each and the third is a General Electric T58 developing 1,050 hp. The two large engines are mounted in the outriggers, one under each main rotor. The smaller turbine is located in the fuselage.

The power transmission system connecting these engines is somewhat unique and Bergen believes it will greatly reduce the vibration problems of current helicopters. Shafting and gearing allows one engine to drive all the rotors in case of power failure, but during normal operation the rotors are not connected together. The rotors are tied to the common shafting by a differential which in effect makes each rotor and the engine located directly under it in the outrigger a separate unit. This greatly eases the torsional loads and vibrations that are set up in locked-together shafts and gears by two big rotating masses such as the rotors. The differential, instead of the shaft, will absorb differences in rotor speed.

An automatic locking device is included to tie the two rotors rigidly together by the same shaft in case of engine failure. This device is triggered by any large change in relative speeds of the two high-speed drive shafts at the differential.

The transmission system also eliminates the need for rotor starting clutches on the large engines. These clutches are often troublesome mechanisms. They are eliminated by bringing the rotors up to speed with the small free-turbine engine in the fuselage be-

fore the main engines are started.

The main rotor outriggers are interesting structurally. They are trussed with the sheetmetal frame carrying compression loads, and the cables carrying tension loads induced by rotor thrust.

Aerodynamic controls of the Bergen crane would be simple so as to reduce complexity, maintenance cost, etc. They would be adequate to accomplish the rather limited maneuvers demanded of such an aircraft. Collective pitch changes could be applied to both main rotors at once or to all three rotors separately. None of the rotors would have cyclic pitch control. A mechanically simple but flexing hub support is proposed to counteract the blade gyroscopic moments that are normally overcome by cyclic pitch.

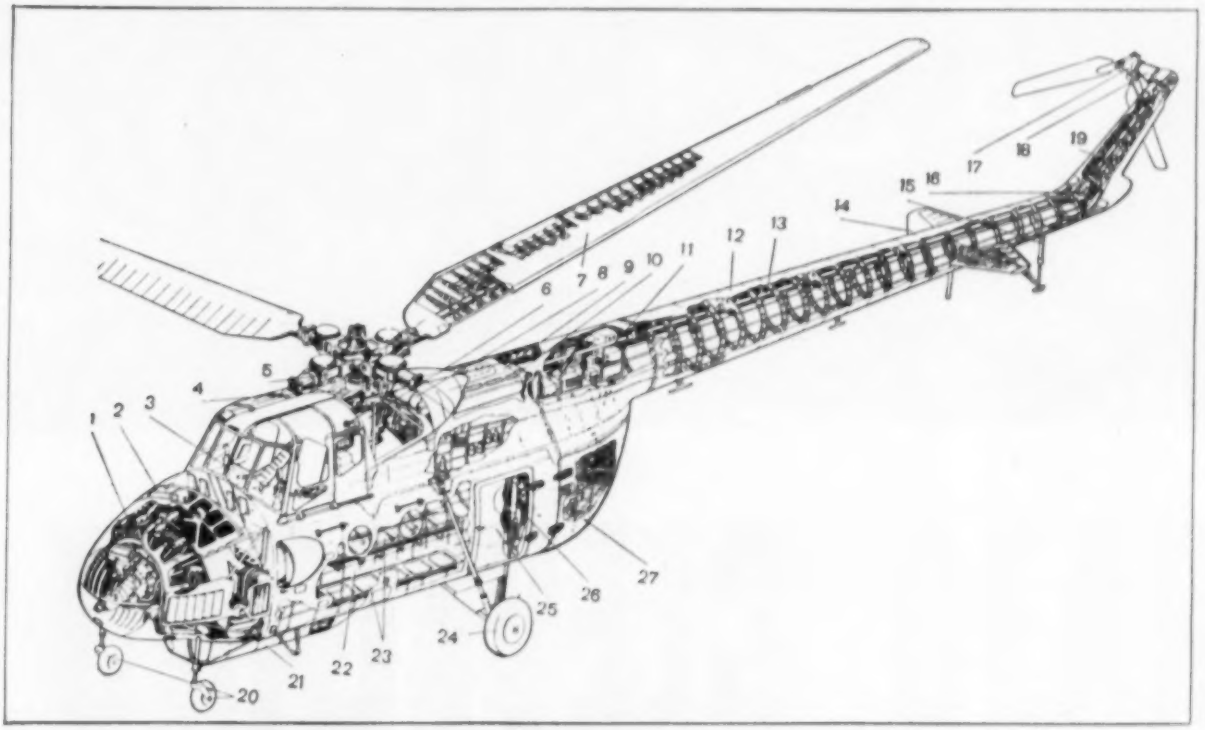
Inclination of the rear rotor lift vector to give the crane directional control would be accomplished by rotating the rotor from side to side about the longitudinal axis of the aircraft. Cyclic pitch control on the rear rotor could be incorporated, if desired, to provide directional control.

Forward flight would be effected by increasing power to the rear rotor to pitch the crane forward. Collective pitch to all of the rotors would have to be increased to maintain altitude.

The two main rotors rotate in opposite directions to counteract their torque. The torque of the rear rotor is neutralized by the jet exhaust from the main gas turbine engines in the outriggers.

Estimated original and operating costs of this crane are some indication of the fiscal realities which must be faced before our Army becomes truly airborne. Flyaway cost of this crane would be about $900,000 and total operating cost per flying hour would be more than $1,000. This is based on 30 hr. of flying per month, which is realistic for Army rotary wing aircraft. Cost per ton-mile is estimated at $1.20.

Aerodynamic portion of the Bergen proposal was principally the work of Prof. Gordon B. McKay of Columbia University who devotes about two-thirds of his time to Bergen. Fred L. Parsons and Stan W. Baker, president and vice president respectively of Bergen, have extensive experience in mechanical power transmission and were primarily responsible for the transmission design.



Soviet Designer Extols Mil-4

Russia has released additional details of its large, single-rotor Mil-4 helicopter which is now employed widely in the U.S.S.R. for both military and commercial operations.

According to designer M. L. Mil, the Mil-4 has "twice the gross weight, engine power and lifting capacity of the American Sikorsky S-55." He adds that "when the Mil-4 went into quantity production at the end of 1952, it had no equal abroad and, in fact, was several years ahead of anything built by foreign helicopter manufacturers."

Mil says the Mil-4's gross weight is 15,873 lb. The Ash-82V engine, designed by A. D. Shvetsov and P. A. Solvyev, develops 1,700 hp. (Sikorsky S-55A normal gross weight is 7,500 lb. and payload is 2,312 lb. Its Wright R1300 engine develops 700 hp.)

Normal load is 2,646 lb., but this figure is increased to 3,527 lb. in the transport version. Rotor diameter is 68.9 ft. It is equipped for blind and night flying, has an anti-icing system and "hydraulic servo-control." In 1956 the craft reportedly set world speed and altitude records by flying 116.4 mph. and rising to 19,742 ft. with a 4,410 lb. useful load.

In its military version, the craft has a cargo compartment which can accommodate a Soviet jeep, a small passenger car or artillery pieces. Parts grouping of Mil-4 helicopter: 1—engine; 2—oil tank; 3—pilots' cabin; 4—automatic swash plate; 5—hub of lifting rotor; 6—main reducing gear; 7—blade of lifting rotor; 8—hydraulic tank; 9—gasoline tank; 10—small tank with de-icing fluid for blades of lifting and tail rotors; 11—radio equipment; 12—tail boom; 13—transmission; 14—stabilizer; 15—tail skid; 16—intermediate reducing gear; 17—tail rotor; 18—tail reducing gear; 19—end boom; 20—front wheels; 21—navigator's gondola; 22—cargo compartment; 23—passenger seats; 24—main landing gear; 25—side door; 26—crane with hoist; 27—doors of cargo hatch.

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Friendly Foe

When a new air defense missile is produced, its "kill accuracy" is theoretical until it is tested against a realistic target under operational conditions. The new, supersonic missile target, **USAF XQ-4,** is one of many "friendly foes" developed by Radioplane to simulate various air enemy threats.

Duplicating the performance and radar appearance of a supersonic, high-altitude bomber, the radar-controlled XQ-4 is designed to test the seek-and-kill ability of air defense systems and their missiles.

As major advancements have been made in U.S. Armed Forces air defense weapon systems, Radioplane has designed and developed targets compatible with the missions of these weapons. The XQ-4, for example, not only imitates invading bombers, but tallies up the score of hits and misses when fired upon.

Radioplane, the first to produce remotely controlled target aircraft, maintains dynamic research programs to seek low-cost solutions for tomorrow's defense problems.

Radioplane

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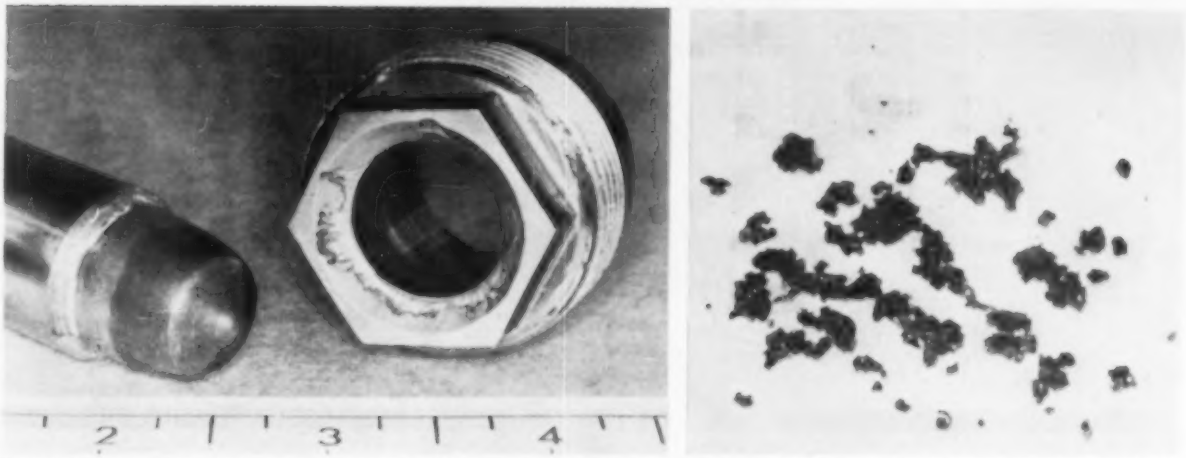


STELLITE valve seat at plunger (left) eroded after 20 hr. operating time. Temperature varied between 100-450F; pressure between 1,000-5,000 psi. Silicon contaminates formed (right) as a result of testing with Oronite 8515 fluid at 700-800F.

Hydraulic Designers Fight Heat Effects

By Russell Hawkes

Conventional hydraulic fluids and component materials can't fulfill heavy demands of new hydraulic services or withstand high hydraulic system temperatures caused by aerodynamic heating.

Use of hydraulic boosted flight controls calls for high response rates and raises such new problems as resonance and coupling between hydraulic system pressures and airframe deflections.

Special requirements of missiles also contribute to the rapid change of hydraulic technology, and on the horizon are such problems as gamma and neutron radiation effects.

Changes to Come

Biggest changes in hardware due to high temperatures are yet to come. Hydraulic system engineers at Pacific Division of Bendix Aviation Corp. estimate that 70% of current production is intended for temperatures to 260F, 25% for temperatures to 350F and 5% for temperatures to 1,000F. This proportion of high temperature units is probably greater than the industry average since Bendix provides the hydraulics on the Convair B-58, first large supersonic plane. They predict that in the next two years the proportions will change to 50% for 160F applications, 40% to 350F and 10% to 1,000F, then remain constant for about five years.

Keystone in the complex of problems facing the designer of a high temperature hydraulic system is the problem of finding an adequate fluid. Adverse effects of elevated temperatures on conventional hydraulic fluids include tendencies to:

- **Become spongy** and compressible, absorbing part of the energy they are expected to transmit.
- **Coke out** carbon-like deposits that tend to clog filters and stop valves and ports.
- **Develop alcohols**—raising vapor pressure and lowering flash point and viscosity.
- **Become increasingly** corrosive on materials in the system.
- **Lose their** lubricity.
- **Evolve** gases.

Silicate Ester Fluids

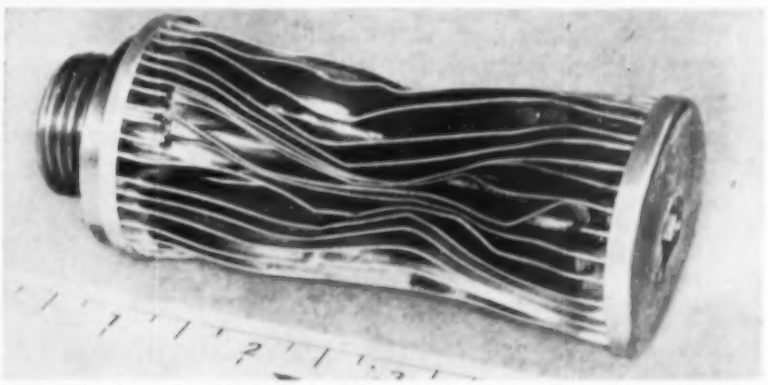
Petroleum base fluids are useful only to about 275F. Silicate ester based fluids are being developed for use to 450F and liquid alkali metals have been discussed for use at temperatures as high as 1,500F.

At Wright Air Development Center, the most promising of the liquid metals is considered to be eutectic alloy of sodium and potassium, NAK 77, with a boiling point of 1,443F and a melting point of 10F.

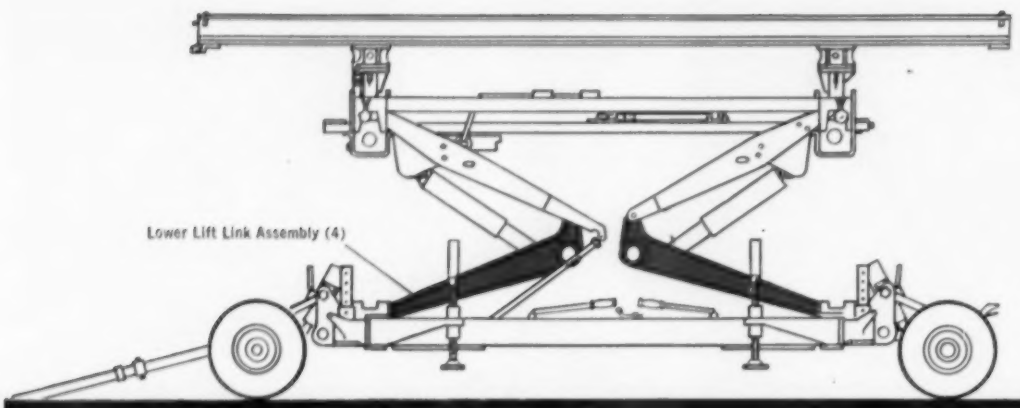
First Application

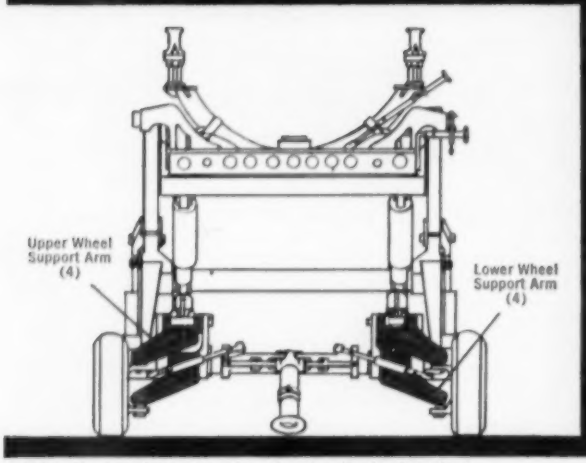
First of the silicate ester fluids to find application is Oronite 8515 which is used in the B-58. Oronite 8200, another silicate ester, will replace 8515 when packing materials are found which will work with it at −65F. It has better viscosity and stability characteristics than 8515.

The B-58 is typical of the upcoming airplanes which will raise the heating problem in hydraulics. Its 200 hp. hydraulic system operates at 350F and one component has a 10 hp. system in which a temperature of 500F is reached briefly. Both must be capable of starting at −65F. Since Bendix has found that a system which is acceptable for



WIRE mesh filter collapsed after being clogged with silicon that was formed from high temperature testing. This is one difficulty that faces hydraulic system designers.





Kaiser Aluminum forgings are shown in red on the drawings above.

ALUMINUM FORGINGS SAVE UP TO 50% IN COSTS — 50% IN WEIGHT

As determined by Air Logistics Corporation cost analysis, the forged aluminum wheel support arms shown above returned a 50% cost saving, as compared to steel weldments. The lower lift arms returned a 10% cost saving.

These same aluminum forgings also made possible the following savings in weight as compared to steel: Wheel support arms—50% weight saving; lower lift arms—40% weight saving. Yet the trailer shown is strong enough to handle loads up to 8000 pounds.

And, as additional advantages, the aluminum forgings provided superior springing action and added pleasing appearance to the trailer.

Next time you're faced with a design problem involving costly and complex parts machining and assembly, consider the inherent advantages of single aluminum forgings.

For complete information contact the Kaiser Aluminum sales office listed in your telephone directory. Kaiser Aluminum & Chemical Sales, Inc., General Sales Office, Palmolive Building, Chicago 11, Illinois; Executive Office, Kaiser Building, Oakland 12, California.

THE BRIGHT STAR OF METALS **KAISER** *Aluminum*

continuous operation at 350F will be acceptable at 500F for a short time, it is designed to the more critical requirement of 350F continuous operation.

B-58 Hydraulic System

The system operates at the usual pressure of 3,000 psi. It is a dual system powered by four engine-driven pumps moving about 30 gal. per minute at 160F. Highest ambient temperatures are estimated at 260F. A cooler is incorporated in the system to prevent temperatures exceeding 350F and a thermostat control holds temperatures above 100F. Shorter temperature range reduces temperature dependent variations in hydraulic functions.

Largest proportion of system heat has been found to be produced at the pumps. Most of the remainder is due to hydraulic conversion at the flight controls.

Use of a silicate ester base fluid like 8515 has dictated certain precautions:

- **Atmospheric air** is sealed out to avoid moisture and hydrolysis. Fluid is driven into system from storage containers by pressurized nitrogen.
- **Nitrogen atmosphere** is maintained in ground test cart and test bench reservoirs.
- **All other fluids** are assumed to be contaminants. It was found that in the presence of oxygen, a small admixture of 5606 to 8515 causes bulk gelling.

Fluid Life

Nitrogen pneumatic charge is used in all accumulators since air diffused from an accumulator pits aluminum in a line several feet away during prolonged operation at high temperature. Fluid replacement in maintenance operations is expected to be controlled directly by retention of properties rather than on length of service. Engineers at Bendix Pacific Division would prefer to do it this way because wide variations in service conditions and high price of fluids make it difficult to set an arbitrary service life without accepting a costly loss in fluid utilization. Bendix is designing a field kit for determining fluid properties. Only viscosity breakdown and contamination seem critical but oxidation into alcohol is another possible criterion. After more than a year of use in one test, flash point of 8515 fell to 220F because of alcohol formation though viscosity remained within limits.

The system has been designed to purge gases to the reservoirs automatically for single point bleed-off. Initial filling and routine maintenance are done without breaking into the system. Cadmium plate is the only conventional material specifically excluded from the system because of fluid in-

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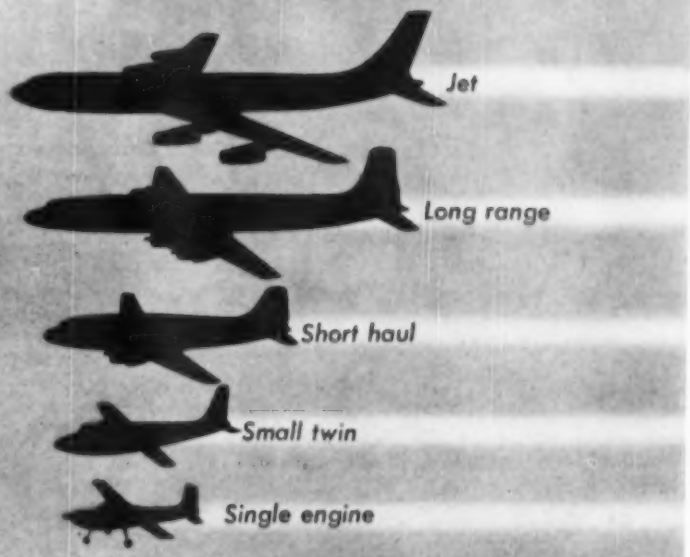

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2. Send all entries to K&E Albanene Contest, Box 160, New York 46, N. Y. Enter as often as you wish. There is nothing to buy.
3. Entries must be postmarked not later than midnight, Nov. 30, 1957.
4. Entries become the property of Keuffel & Esser Co. None can be returned.
5. The decision of the judges is final.
6. Winners will be notified by mail. A complete list of winners will be sent upon request, providing request is accompanied by stamped, self-addressed envelope.
7. Contest is open to all residents of continental United States, except employes, and their immediate families, of Keuffel & Esser Co. and its subsidiaries and dealers; its advertising agency; and judges of this contest.
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Or use a plain sheet of paper if someone's already snipped the blank below. Give your name, address, and firm name, twenty-five words or less telling why you prefer Albanene tracing paper, and mail to K&E Albanene Contest, Box 160, New York 46, N. Y. before midnight, November 30, 1957.

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compatibility. At the elevated temperatures in this system, even 5605 fluid, would strip cadmium. Most aluminum alloys are acceptable but some selectivity is required. Conventional electrical varnishes are stripped by 8515 but epoxy and nylon are unharmed.

Silicate esters retain fairly constant viscosity, fairly good thermal stability and low volatility over a wide range of temperatures but are hydrolytically unstable in the presence of water. Also at temperatures around 300F-400F, lubricity falls below that of present mineral base fluids in the 200F-250F range. First of the experimental high temperature fluids, MLO 8200, was a blend of hexa (2 ethyl butoxy) disiloxane and polymeric silicone to improve viscosity index.

Addition of 15% diester or ester as a swelling agent gives adequate physical properties, including good rubber swell.

Sealing Technology

Most of the technology of sealing, which is a fundamental problem in hydraulics, deals with resilient compounds. Aircraft and missiles are leaving the temperature range where these are practical. It is hoped that materials now appearing on the scene will push the limit of plastics to 500F.

As in other branches of aircraft design, hydraulics engineers are running out of the store of basic knowledge about behavior of metals and other materials at high temperatures. Accepted metal aging or stabilizing processes are no longer adequate. Tighter limits on tolerances are raising another set of manufacturing problems. Techniques for holding tolerances to ten-thousandths or millionths of an inch are based upon the use of very hard materials which are bad from the standpoint of residual stresses. This conflict between manufacturing and application may not allow the usual compromise solution.

There are indications that one of the worst bugaboos will be erosion. Metal is more susceptible at elevated temperatures and fluids are more active chemically. Cavitation also becomes more likely. How serious a threat this will be is not yet known. Theoretically, the amount of energy released at a point by the implosion of small bubbles of vapor approaches infinity because it is all directed at a single dimensionless point. If this point were close to a surface the implosion might very well carry away minute quantities of metal. This is the principle upon which ultrasonic vibrating cleaners work. Cavitation can also be caused by the metering or redirecting of a high velocity stream.

Design Headaches

Limitations on size and weight in a crowded modern airframe oppose a number of obvious ways to ease the designer's problem. Large diameter lines and high volume actuators, motors and pumps would lower fluid velocity and cure a host of ills, but there is no room for bigger pieces and the weight penalty for a bigger volume of fluid is unacceptable. Small, high velocity lines result in turbulence and the conversion of

Sputnik Rocket Leaves Trail

Third stage of rocket which launched Russian Sputnik into orbit leaves a white trail in time exposure photograph made by an Australian observatory. U. S. observers detect gradual speeding of orbit time, indicating its life is near end.

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much power into heat. Ultimately, Reynolds number determines line size. A tendency to go to higher pressures compounds these troubles, produces the threat of bad local heating and erosion where fluid is metered at valves and orifices. There is little that can be done to prevent heating of this sort. Heating due to fluid metering may put local temperature over the red line when average temperatures approach design limits.

It has been suggested that orifices be replaced by tubes to reduce the concentration of heating, but variations in viscosity would affect its value. Much conversion takes place at the pump and it has been suggested that if electromagnetic pumping can be made practical this will be much reduced or even climated.

Some alkali metals appear to have acceptable properties for applications up to 1,500F, according to a recent Wright Air Development Center technical report by Richard H. Blackmer. He has concluded from the results of Atomic Energy Commission heat transfer studies that eutectic of sodium and potassium (NAK 77) is the most promising high temperature liquid now known.

Unfortunately, its melting point is 10F, far above minimum acceptable temperatures now specified. This difficulty might be sidestepped by operating the system continuously on the ground and passing the fluid through heaters. Research may discover a third alloying material which will depress melting point.

Cesium and thallium have been suggested as possibilities.

A few eutectic alloys have lower melting points than NAK 77. Melting points listed by WADC are:

- **Potassium** (77%) and sodium (NAK 77) (23%) is 10F.
- **Cesium** (24%) and potassium (76%) is −55F.
- **Cesium** (13%) and rubidium (87%) is −40F.
- **Cesium** (5%) and sodium (95%) is −20F.

NAK 77 Attributes

With the exception of cesium-sodium, corrosiveness and fluid properties of the other metals are less satisfactory than those of NAK 77. But a better insight into Air Force reasons for preferring NAK 77 is given by a comparison of costs (based on 1951 data):

- **Rubidium**—$2,100/lb.
- **Cesium**—$1,800/lb.
- **Potassium**—$2.50/lb.
- **Sodium**—$.16/lb.
- **NAK 77**—$2.00/lb.

Availability is an important factor independent of its effect on price. It is estimated that only a ton each of cesium and rubidium were produced in 1951 compared to several thousand tons of NAK 77.

NAK 77 looks much like mercury but in an inert atmosphere is more silvery.

It is very highly reactive with oxygen.

When poured from one container to another its silver color cannot be seen, so rapid is the formation of black oxide sludge on its surface. It will ignite spontaneously in air at 239F, or at room temperature if atomized.

Other NAK 77 Characteristics

Room temperature ignition without atomization has been reported in the presence of heavy moisture.

NAK reacts violently with water, releasing hydrogen and generating enough heat to ignite both hydrogen and NAK if air is present. Water applied to NAK always produces a violent hydrogen explosion.

NAK that is thrown in water sputters, burns hydrogen as it is formed and usually explodes, scattering burning NAK.

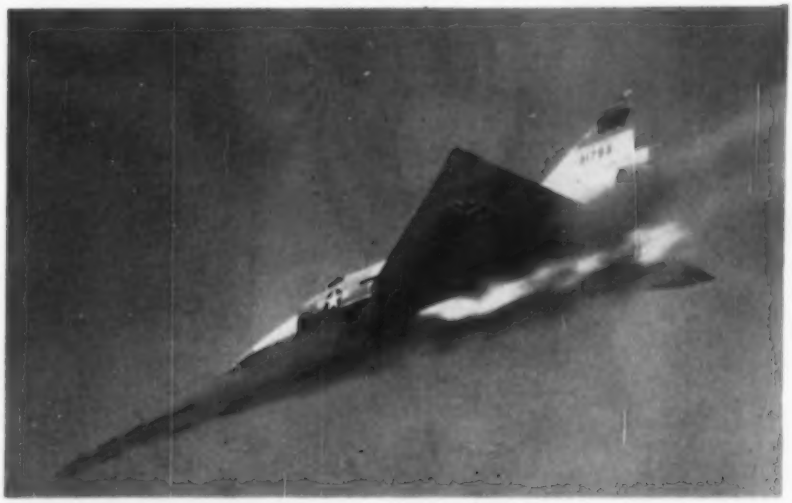
Surface tension of NAK 77 is about twice that of water and one-fourth that of mercury. Ratio of surface tension to density is about five times that of mercury. Specific gravity of NAK is good for a hydraulic fluid. It is less dense than water and not much more so than Mil-H-5606A hydraulic fluid. Viscosity is lower than desirable. At 115F it is about 0.565 centipoise, the same as water.

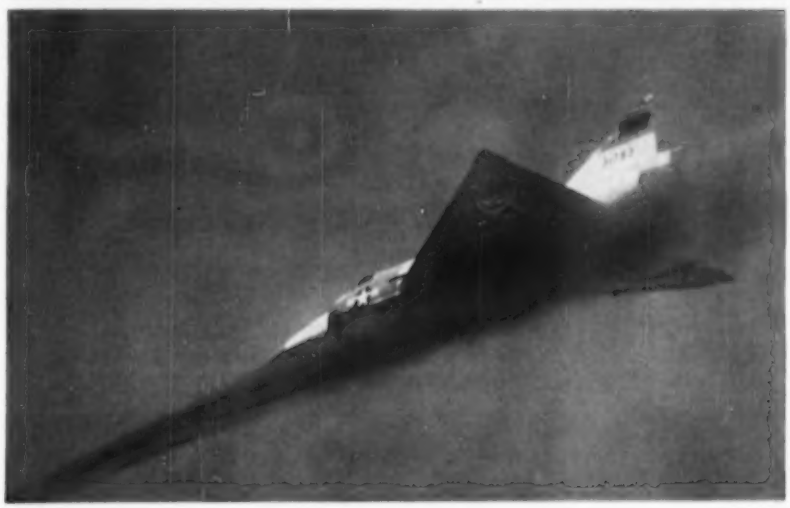
No data on bulk modulus are available but favorable "guesstimates" are derived from data on sodium up to 300F, with extrapolation to 1,000F. These data show sodium to be almost three times as stiff as Mil-H-5606A.

Handling Problems

Handling problems with NAK 77 appear difficult but solvable. A hydraulic system using it must be hermetically sealed and must contain an inert cover gas because of the ease with which NAK oxidizes. When NAK burns,

F-102A Fires 24 2.75 In. Rockets In Rapid Sequence





Convair F-102A fires 24 folding fin 2.75 in. rockets in less than half a second. Rockets leave tubes in the missile bay doors of the interceptor two at a time, and the first pair are caught by high speed camera (upper left). Two tenths of a second later (lower left) the full exhaust blast of the 24 rockets has blossomed. Small metal scoops opposite the three rocket tubes in each of the F-102's four missiles doors deflect exhaust debris from structure. Aircraft's coat of protective gray enamel resists corrosion from rocket blast, and blast is so brief only a thin film of dust remains as evidence of firing. High speed camera exposed 20 frames per second to catch the rockets streaming out in flight (right).

combustion is cool and non-explosive if no water is present, but fumes are dangerous to breathe, being dense and caustic.

Oxide contamination increases corrosivity. With oxygen concentration greater than 0.005%, attack of ferrous alloys is accelerated. A concentration of 0.1% of sodium oxide will embrittle the surface layer of stainless steel, causing it to crack when deformed. Oxides are precipitated out of the fluid by a local temperature drop and can clog the system. It is possible to capitalize on this failing by incorporating a cold trap for oxides. A temperature drop of 200F between the line and the cold trap appendage would just about preclude the possibility of oxides collecting elsewhere in the system.

Selection of materials for use in a high-temperature NAK hydraulic system must be based mainly on:

- **Resistance** to corrosion.
- **Mechanical** properties at high temperatures.
- **Bearing** properties.
- **Resistance** to diffusion bonding (self-welding).

Many materials are compatible up to 1,000F, but only a few such as carbides, borides and tool steels offer acceptable bearing combinations. This is a very important consideration since the lubricity of NAK is negligible. Even the best bearings have friction coefficients 10 times as high in NAK as in light oil. As yet, there is little information available on lubricity additives or dry film lubricants.

Tendency of some materials to self weld in applications like valves and seats is enhanced by the presence of NAK.

D. W. Douglas, Jr., Succeeds Father

Santa Monica, Calif.—Donald W. Douglas, Jr., 40, was named president of Douglas Aircraft Co. last week, succeeding his father.

The senior Douglas, who founded the company 37 years ago, remains as chairman of board.

Frederic W. Conant, senior vice president, was appointed vice chairman of the board and will represent the chairman in the latter's absence.

John Dundas, vice president of administration, was named executive vice president and a director of the aircraft company.

Gen. Ira. C. Eaker, USAF (ret.) was elected vice president in charge of the company's eastern offices. He joined the company Oct. 15.

Douglas testing division has joined the engineering department under the leadership of Arthur E. Raymond, vice president of engineering. All sales activities including military as well as commercial will now come under the cognizance of Nat Paschall, vice president of sales.

Donald Douglas, Jr., was formerly vice president in charge of military relations.

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Ticketing Handset 'Reads' Pencil Marks

By Philip J. Klass

Toronto—Transactor, new device which should speed the processing of airline reservations and provide valuable operational data for flight scheduling, has been developed here by Trans-Canada Air Lines and Ferranti Electric Ltd.

TCA has also developed new airline data processing techniques which it says can cut cost of equipment investment, yet speed up reservations handlings.

Combination of Transactor and new techniques is expected to reduce by 60% the 3½ million separate transactions now required to board some 250,000 TCA passengers every month. TCA is expected to request bids from industry for its proposed system in the near future. Ferranti, which designed the prototype Transactor, will bid also for the computer portion of the system.

TRANSACTOR, new airline agent handset for interrogating automatic reservations computer (above) automatically "reads" pencil notations drawn by ticket agent on reservations card (below). Punched marks along right edge show space was sold, subsequently canceled, for one seat on Flt. 820, on July 29, Winnipeg to Montreal.

Versatile Transactor

Transactor bears a slight resemblance to the agent handsets now used by many airlines for interrogating automatic reservations computers but differs in one very important respect. Where conventional agent handsets require the ticket agent to select and insert a metal plate and then punch appropriate keys, the Transactor automatically and instantly "reads" pencil notations made by the agent on a small card, then interrogates the computer for the requested space.

This means that the Transactor can, without modification, handle a number of different types of cards to provide other than space-availability information. For example, the machine can interrogate the computer for the total number of passengers on any scheduled flight (manifest check), on the location and estimated time of arrival of any en route airplane, or almost any other information of interest that can be stored in the computer.

Flight Plan Use

This flexibility suggests that the Transactor could also be used to enter aircraft flight plans in a traffic control computer and as an input-output device for many other non-airline applications.

When a ticket agent receives a request for space (by phone or in person), he takes down the required information on an IBM-size card using an ordinary soft lead pencil. Information on such things as originating station, destination, flight number, date, number of seats requested, etc., is recorded on the card by drawing a pencil line between pairs of tiny circles on either side of the desired number or code (see card above).

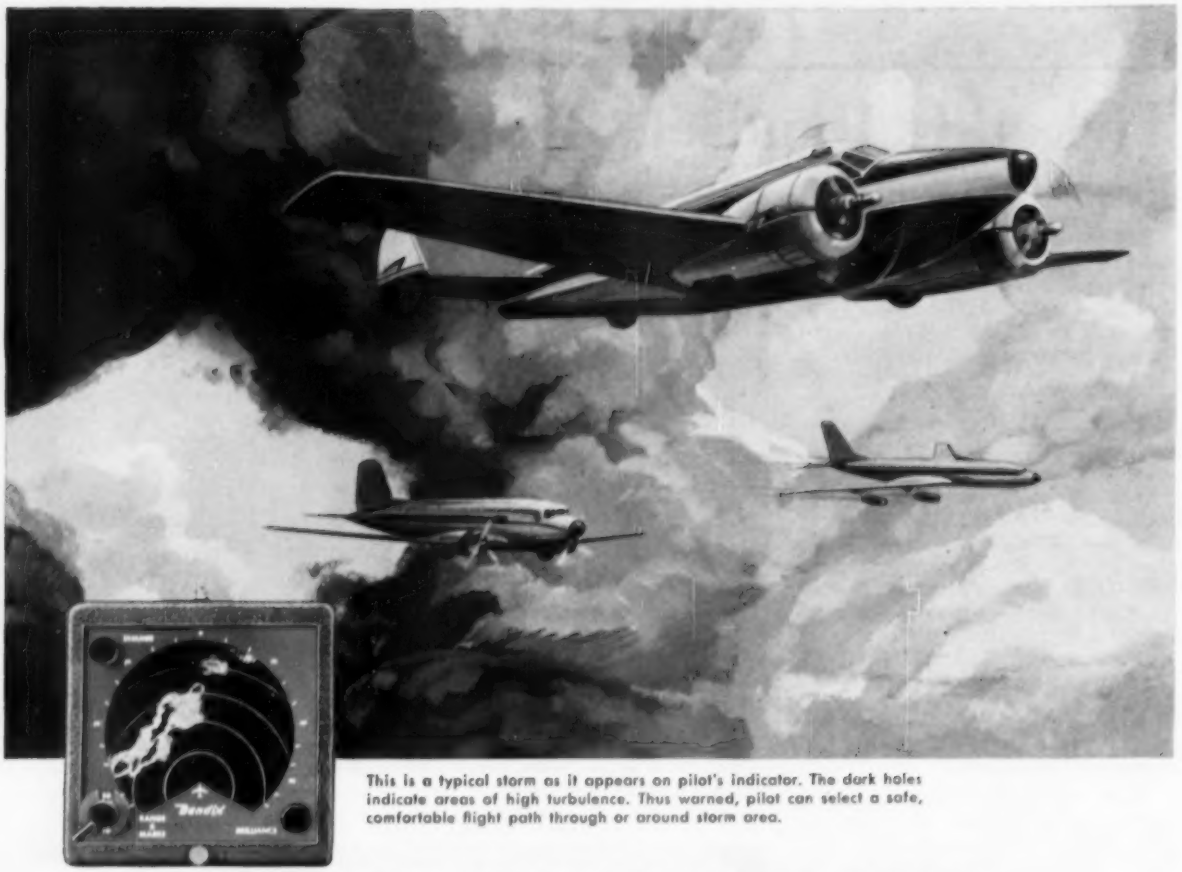
Passenger name, address and telephone number are spelled out in conventional fashion, but could be recorded by pencil lines if TCA should decide to store such information automatically.

When the card is filled out, the agent inserts it in the Transactor's slot. The card is mechanically gripped to prevent its withdrawal for two or three seconds until the operation is completed. Inside the device, 300 pair of tiny electrical brushes make electrical contact with up to 300 pairs of tiny circles. If a pencil mark has been drawn between any pair, current will flow through the carbon path of the pencil line. Otherwise there is no current flow.

In less than one second the Transactor has electrically scanned (read) the message and the information or interrogation is on its way to the central reservations computer.

Reply Punched

When the computer has scanned its reservations inventory, its reply is automatically punched out along the right-hand edge of the card, indicating that space is available and has been sold to the requester, that the flight is sold out.



This is a typical storm as it appears on pilot's indicator. The dark holes indicate areas of high turbulence. Thus warned, pilot can select a safe, comfortable flight path through or around storm area.

FIRST "150-MILE" WEATHER RADAR THAT FITS ALL THREE!

There's a big difference in the size of the aircraft shown above. There's a big difference, too, in the jobs they are required to perform. But one thing they do share in common—an ability to fly safely and smoothly either through or around storm fronts or other dangerous weather conditions. For all three are equipped with the new Bendix* RDR-1D Airborne Weather Radar System.

Substantial weight and size reductions, without impairment of quality or performance, now enable Bendix to offer this 150-mile-range, airline type weather radar equipment to a much wider variety of business and commercial aircraft.

Performance equals that of present commercial weather radar systems requiring twice the amount of electronic rack space. Total system weight is now approximately 85 pounds. For aircraft lacking sufficient space for the larger 22- and 30-inch "dish" antennas, new 15- and 18-inch sector scanning antennas will be available.

What's more, the new components are interchangeable with Bendix' famed, time-tested veteran of the global airways, the RDR-1B X-Band System. In addition to its primary function, this new RDR-1D system matches its famous counterpart for ground mapping and terrain avoidance.

For complete information, write to Bendix Radio, Aviation Electronic Products, Baltimore 4, Maryland. Or West Coast—10500 Magnolia Blvd., N. Hollywood, Calif.; Export—Bendix International Division, 205 E. 42nd St., N. Y. 17, N. Y. Canada—Computing Devices of Canada Limited, P. O. Box 508, Ottawa 5, Ont.

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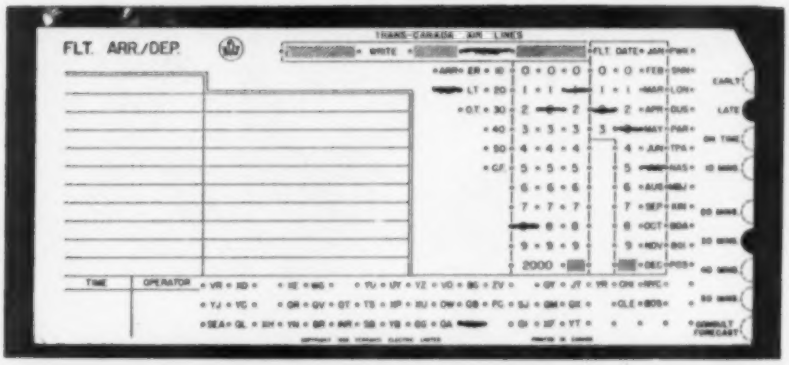

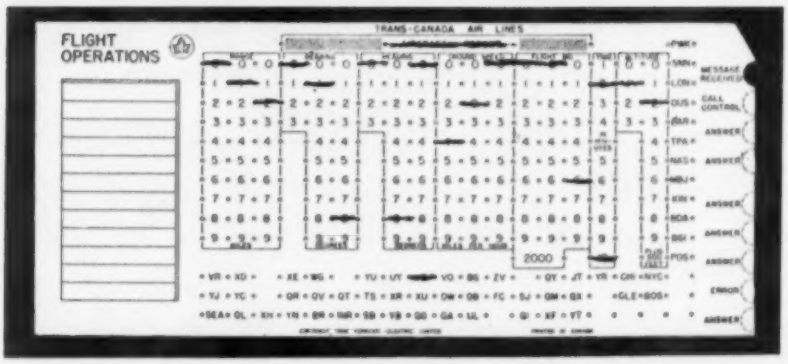

Similar cards can be used to obtain or enter information on flight arrival/departure times (above) or on location of en route aircraft for flight operations use (below).

or that an extra section has been added and space is available on it.

If the passenger subsequently telephones to cancel the reservation, the original card is pulled out of a central file, the agent draws a pencil line through the symbol "CNCL," inserts the cards in a Transactor and the space is restored to inventory.

Lyman Richardson, TCA communications analyst who conceived the system, says the card marking operation does not require precise, draftsman-like pencil lines by the ticket agent. Nor is the Transactor fussy if the lines fall a little short or run a bit over the apropriate pair of tiny circles, according to Richardson.

Human Errors

If the ticket agent should ask for space on a day when the flight does not operate, when the card is withdrawn from the Transactor it will be punched "no flt." If the agent fails to include all the information required, the card comes out without any punch. If the agent makes the mistake of asking for a flight between two points which have no connecting flights, or other fundamental error, the Transactor flashes a red light and the card comes out punched "error."

As presently contemplated, the Transactor will not indicate alternate available space when the requested flight is sold out—an operational feature available on the Teleregister Corp. Reservisor agent handset. However, Richardson says this feature can be provided by adding another series of punch indications along the bottom or top of the Transactor card. It would also be necessary to program the central computer to automatically search for alternate available space when a requested flight is sold out.

New Inventory Approach

General practice with existing airline reservations computers is to provide rapid-access inventory of all flights for 30-60 days in advance. Reservations for flights beyond this period, usually small in number, are handled manually and subsequently transferred to the rapid-access computer storage. Some airlines also store a few holiday or other high-load day reservations beyond the 30-60 day period in rapid-access computer memory. This means that reservation requests beyond a 30-60 day period cannot be handled through the automatic reservations system and this involves some added delay.

TCA would like to be able to give an immediate "yes" or "no" answer to any space request, regardless of flight date. After an extensive operations analysis of its reservations experience, TCA believes this can be done with no extra investment in computer storage facilities, and perhaps even less. The technique involves the use of aux-

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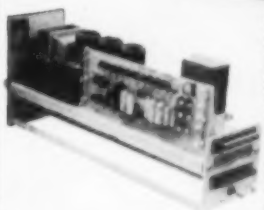

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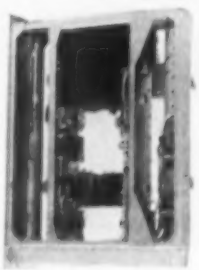

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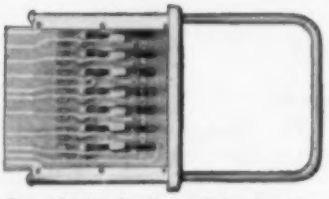

One of 160 plug-in modules for the desk-size Stewart-Warner Data Processing Unit. Modules employ solid state circuitry to save space and eliminate many vacuum tubes.

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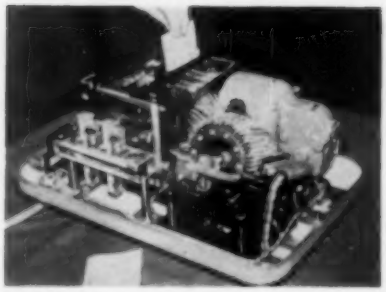

TRANSACTOR, with cover removed.

iliary slow-access tape storage as an adjunct to the main computer memory.

TCA's analysis, for example, revealed that:

• **Fifty per cent** of its reservations activity (making or canceling space) takes place within five days of flight departure; 75% within 10 days.

• **One-hundred cancellations** are made for every 300 original bookings, but more than half of these take place within 48 hr. of flight time.

Richardson therefore believes that the main computer rapid-access memory need be used to store full inventory data on flights only five days in advance. Inventory for any flight more than five days off will be stored in the rapid-access computer memory only if the flight is approaching sell-out. Otherwise the inventory is stored in the auxiliary tape memory. The latter will be scanned at regular intervals and the inventory of flights approaching sell-out will be transferred to the main computer memory, regardless of when the flight will depart.

Speedy Service

When a Transactor requests space for any flight, the computer searches its rapid-access memory. If the flight is more than five days off and is not "listed" in the memory, the computer signals the Transactor to sell the space and records the sale on magnetic tape. If the flight is listed, the computer examines the inventory count to determine whether it can sell space. In either event the ticket agent gets an immediate reply.

The system which Richardson outlined to AVIATION WEEK will be designed to provide a variety of operational data which heretofore has been unavailable or difficult and costly to assemble. For example, it will be possible to obtain periodic summary reports which show how many transactions are made by each station (and each Transactor, if desired) per day, per hour or for any other desired time increment to determine ticket agent personnel needs.

System can be set up to conduct special surveys on any subject. For example, if TCA wants to know what

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There's not much left of a missile or its components after it slams back into the earth with a force of many thousand g's. Since it's vitally important to know what happens during a test flight, inflight data must be remotely collected by telemetry.

The Radiation, Inc. Telemetering Transmitter is designed to ride these missiles and transmit information back to the ground station during the flight. It is built to operate reliably in the extreme environments (100g shock, 2000 cps vibration, —55 to +75°C) encountered by the missile. Its small size, light weight and rugged construction make this transmitter the best available for such applications.

Spurious Rejection	—	60db below carrier
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Frequency Range	—	215-235 mc
Power Output	—	2 watts
Weight	—	1.7 pounds

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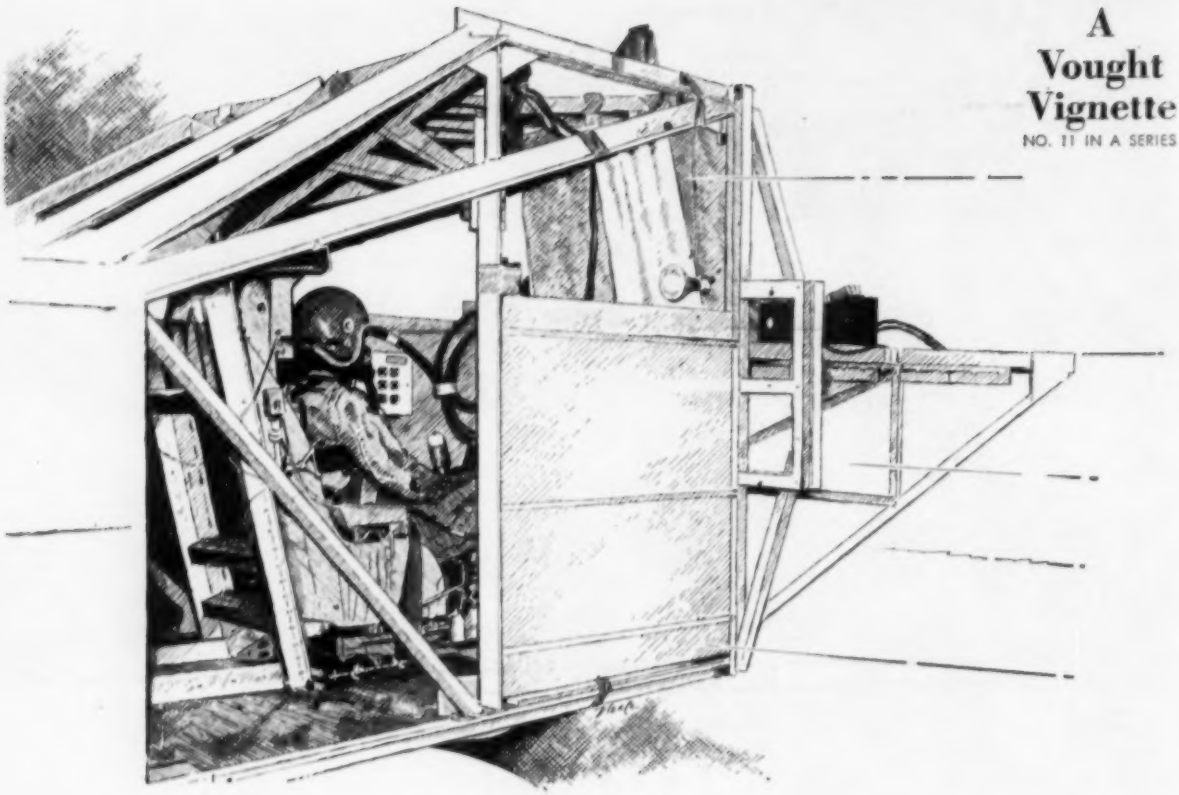


The flight safety engineer who went for a spin

Inside the whirling cockpit, Chuck Miller was confused. He had muffed a spin recovery. He had lunged for the spin chute T handle and missed. Now his numbed hands couldn't hold onto the control stick.

Seconds later the spinning stopped. Flight Safety Engineer Miller climbed out of the University of Southern California's centrifuge, compared notes with a Vought test pilot. Next day they were winging back to Vought. With them was a taped and filmed record of their centrifuge tests. It documented a possible flight hazard and unique measures to prevent it. It also showed the resourcefulness of Vought's Flight Safety Engineers.

They had been alerted some weeks before by a memorandum from Aerodynamics. It concerned model tests of Vought's *Crusader* fighter in the Langley Spin Tunnel. Tests showed the fighter might develop an upright flat spin. This would impose a high transverse (rear-to-front) G load on the pilot.

Aeromedical knowledge was sparse in this area. There was nothing, for example, on how sustained transverse Gs might affect a pilot's judgment and mental orientation. And, to give the project team the needed information, Chuck and his fellow Flight Safety staffers had to find out. Soon Vought pilots would begin the *Crusader's* spin program. Their first job would be to wring a flat spin out of the new fighter — if one were there.

Chuck reserved U. S. C.'s centrifuge for three days of tests. Vought's Structures Test Lab mocked-up a *Crusader* cockpit to fit inside the centrifuge cab. In 27 rides in the centrifuge Chuck and the Vought demonstration pilot who would make the actual flight tests tried spin recoveries under heavy transverse G loads. They encountered unexpected leg cramps. They experienced alarming mental confusion that made only simple functions possible. But before they were done, they had proved out special restraint gear and "dead man" controls that would see a pilot through a flat spin, should one occur.

These safety devices proved valuable, but temporary, accessories. With them, test pilots were equipped for the worst. They could confidently invite the *Crusader* to show a flat spin. Vought's demonstration program was entirely successful and proved that safety devices were unnecessary. The test pilot couldn't flat spin the *Crusader* for love nor money.

Vought's Flight Safety Engineers help improve the reliability and effectiveness of complex weapons. They analyze concepts as well as components. They are a source of systems-conscious development advice. And they work continually to maintain in all departments a dedication to principles of flight safety.

CHANCE VOUGHT AIRCRAFT
INCORPORATED DALLAS, TEXAS

percentage of its customers are unmarried women, it need only instruct its ticket agents to so indicate on each Transactor card by drawing a pencil line through the number "3" in a special survey box on the reservations card. (The survey box comprises five numbers, one through five, to permit five simultaneous surveys.) The system will automatically tabulate the number of "3s" and the total number of reservations entered over the same period, to give the desired answer.

Richardson emphasizes that use of cards instead of a keyboard for entering information into the system permits great flexibility. It is easy to provide more, less, or different information merely by changing the format of the card and reprogramming the computer accordingly.

TCA began its study of automatic data processing techniques more than four years ago. Prototype models of the Transactor were designed and built by Ferranti. System programming techniques were developed by KCS Data Control Ltd., Toronto. Experimental system was evaluated, and demonstrated, using an old (by computer standards) British computer installed at the University of Toronto.

Ferranti spokesman say they expect to sell the Transactor as a computer input-output device for many other applications and currently are negotiating with a U.S. manufacturer who may include the device in a traffic control system being proposed to the Airways Modernization Board. In production quantities, the Transactor is expected to sell for $2,000 or less.

Omega Navigation Aid Could Serve World

By James A. Fusca

New York—Omega, a long range navigation system originally developed for use by totally submerged submarines, has been offered by the U.S. as a possible solution to the problems of air and sea navigation on a world-wide basis. System has an estimated accuracy of better than one mile at its maximum range of from 5,000 to 6,000 mi.

Omega is one of three ground based, long range navigation aids presented by the U.S. at the recent Sixth Communications Division Meeting of the International Civil Aviation Organization.

Developed by the Navy, Omega is an outgrowth of the Radux Mk. I and Mk. II systems program which began in 1949. As presently scheduled, formal evaluation of Omega will begin in 1959 and extend through 1960. In the opinion of some informed observers, international agreement may be reached on a standard long range navigation aid with or without U.S. concurrence before this date.

System Features

Omega's developers say that world-wide coverage can be obtained with a minimum of six ground installations, each costing in the neighborhood of $3 million. Optimum coverage, however, would be obtained with a total of 10 stations. Five of the stations probably would be near the equator, two near the Arctic Circle and three at the southern extremities of South America, Africa and Australia, with all stations about 5,000 mi. apart.

Transmissions of all stations are synchronized with transmitters operating at very low frequencies (10-14 kc.). Exceptional phase stability of these frequencies and their long range propagation characteristics give Omega its effective range of 5,000 to 6,000 mi.

Omega operates in a manner similar to that of Delrac, the proposed British very low frequency (VLF) system. Phase of the signals from two stations are compared to determine a hyperbolic line of position; two intersecting lines of position provide a position fix.

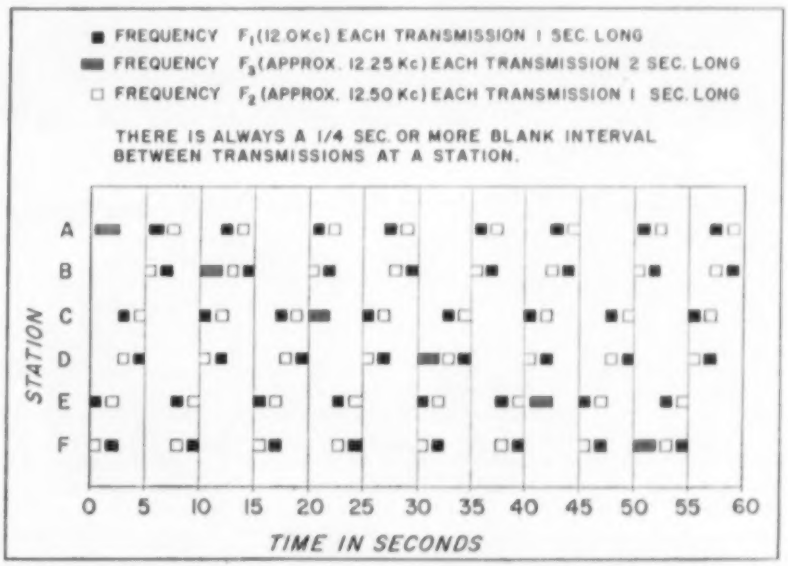
According to its developers, the advantages of the Omega system are:

- **Minimum number** of ground installations is required to provide world-wide navigational coverage.
- **High reliability** results from the propagation stability of very low frequency transmissions.
- **Line of position accuracy** of a high order which results from the phase stability of VLF transmissions.
- **Position accuracy** which is maintained nearly uniformly throughout the area of coverage because the curvature of the earth insures that the hyperbolic lines of position do not spread as far apart when leaving the baseline as in short baseline systems such as British Decca.
- **Omega** is a compatible system for both air and surface navigation which operates in the 10-14 kc. band internationally allocated for navigation purposes.

Original Radux program began in 1949. First phase was the development of a 40 kc. system that used 200 cps. modulation of the carrier to resolve the ambiguity (the problem of distinguishing one cycle of phase from another) inherent in continuous wave phase comparison systems. This system was installed and tested in an experimental network with stations in Hawaii, San Diego, Calif., and Bainbridge, Md. The network has been operational since 1952.

Level of Accuracy

Radux system, with its baselines of slightly more than 2,000 mi., proved in its first evaluation tests to provide system accuracies of 9 mi. with 95% reliability. Continued development during the past three years has improved this figure to 4 mi. (with 95% reliability). The system has been in nearly


FREQUENCY F1 (12.0 Kc) EACH TRANSMISSION 1 SEC. LONG
FREQUENCY F3 (APPROX. 12.25 Kc) EACH TRANSMISSION 2 SEC. LONG
FREQUENCY F2 (APPROX. 12.50 Kc) EACH TRANSMISSION 1 SEC. LONG
THERE IS ALWAYS A 1/4 SEC. OR MORE BLANK INTERVAL BETWEEN TRANSMISSIONS AT A STATION.
STATION
A
B
C
D
E
F
0 5 10 15 20 25 30 35 40 45 50 55 60
TIME IN SECONDS

TRANSMISSION schedule of a typical six-station Omega network. Synchronization signal F_3 is not required if time is known to better than 2.5 sec. and may be discontinued.

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continuous operation for five years and the Navy considers its techniques to be tried and proven.

In 1955, based on the results of propagation studies at very low frequencies (below 30 kc.), a vernier 10 kc. continuous wave phase comparison system was proposed as an adjunct to the 40 kc. system. In this way the accuracy, range and reliability of the 10 kc. system could be used, with the ambiguities of the system resolved by the modulation-phase measurements of the 40 kc. system.

In this version of Radux, sequential transmission of both 40 and 10 kc. are required at each ground station of the system. Equipment for the system exists and an evaluation program is now in progress.

Absolute accuracy of the 10 kc. portion of the system is indicated as being better than one mile throughout the area of coverage. Although the 10 kc. transmissions can be received at 5,000 to 6,000 mi., the usefulness of the combined 10/40 kc. system is limited by the shorter 3,000 mi. range of the 40 kc. portion.

Evolution of Omega

A series of propagation studies concluded in 1956 indicated that the advantages of the 10 kc. system could be preserved in a dual-frequency continuous wave—phase comparison system operating entirely within the 10-14 kc. band. This system would have the range and accuracy of the 10 kc. portion without the range limitation of the 40 kc. portion of the combined system. This new system has been called Omega.

According to its developers, equipment for Omega is essentially the same as for the earlier Radux systems and will not require the development of any new circuitry or techniques. Since Radux was primarily for ship navigation, however, only limited flight testing of the equipment has been done, but these tests have shown no decrease in accuracy beyond that caused by servo lag in the receiver. For an airborne receiver, dead reckoning inputs would eliminate this lag and provide aircraft position accuracy equivalent to that achieved on shipboard.

Principles of Operation

A typical Omega network would consist of six synchronized stations, each operating on a basic and secondary frequency separated by approximately 500 cps. All ground stations of the network transmit both the basic and secondary frequencies sequentially in a fixed pattern. A line of position is obtained in the navigation receiver by determining the arrival time difference of the basic frequency signals from two of the synchronized ground stations.

Resolution of the ambiguity arising from time difference measurements of the basic frequency alone is obtained by determining the difference in time of arrival of the secondary frequency signals broadcast by the same two stations, and then comparing the basic and secondary time differences. This technique provides reliable resolution of the ambiguity in line of position while retaining the accuracy of the line of position.

The time differences of the system are measured by automatic phase comparison techniques in the receiver that are accurate to 1/100 of a cycle. Transmissions of both the basic and secondary frequencies are synchronized or "locked" at all ground stations.

Transmission pattern for each fixed station will consist of a synchronizing transmission of about two seconds duration, eight one-second transmissions at the basic frequency and eight one-second transmissions at the secondary frequency during each minute of transmission time.

For most applications the synchronization signal will not be required, but is being retained in the system for the present because there appear to be some applications where it will be useful.

An Omega ground station will re-

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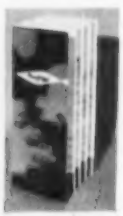
1942

Grumman Torpedo Bombers help sink four Japanese aircraft carriers in Battle of Midway Island — Japanese task forces turned back.



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quire a VLF antenna system capable of handling the power needed for the system. A typical antenna array would be a four-tower system with three of the towers at the corners of a 1,500 ft. equilateral triangle and the fourth in the middle of the triangle.

Each tower would be about 625 ft. high. Tower tops would be connected by cable to improve top-loading. A 4,000 ft. diameter circular ground system would be required for this type of array, and a circular area 3¼ mi. in diameter would be required for the site.

For users who will start out within the system at a known point, who will stay within the coverage area at all times and who will have a means of knowing time to within a few seconds, a simplified receiver capable of full system accuracy but not equipped with synchronization or ambiguity resolution will be developed. The user will be required to know time to within two seconds and his position to within 3 mi. at his start of operation.

For the user who knows time to within a few seconds but knows his start position only within 75 mi., or who cannot remain in a usable signal area continuously, a receiver having ambiguity resolution will be required. A third receiver can be provided for those applications where time is not known with sufficient accuracy and the receiver must supply its own synchronization.

Position readout to date has been by display of hyperbolic coordinates on dials. These outputs, however, can be taken out in either analog or digital form and the development of a chart display device or other special display for use by aircraft poses no real problem.

Lightweight Computer Designed for Aircraft

Los Angeles—Ramo-Wooldridge Corp. announced today that its Computer Systems Division has developed a new digital airborne computer that is designed to provide a lightweight compact computing control center for high performance military aircraft.

Completely transistorized device, designated the RW-30, employs specially designed digital computing techniques and will perform all computations for navigation fire control, bombing and weapons control with the speed demanded by modern weapon systems.

The RW-30 was designed by the Ramo-Wooldridge Computer Systems Division in a program undertaken in late 1954 under a development contract with the Air Arm Division of Westinghouse Electric Corp., Baltimore, Md. Objective of this program, just completed, was to develop a system which would perform reliably in an

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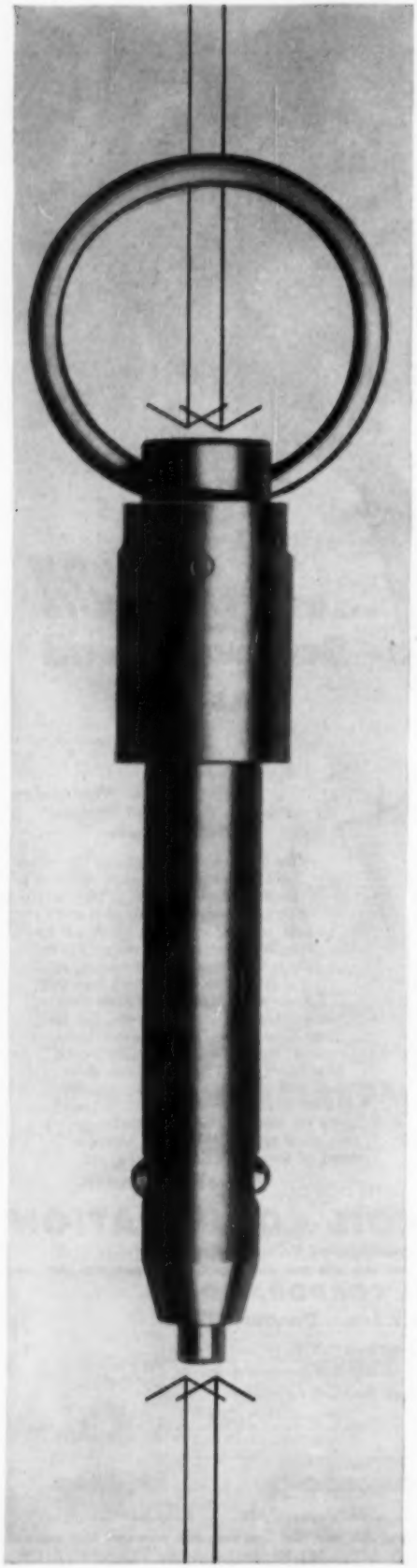

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The RW-30 is described as the fastest airborne magnetic drum computer in operation today. It can conduct 4,000 complete arithmetic operations per second, including access time, and requires only 400w. of power, permitting a significant saving in aircraft auxiliary power equipment.

Expansions, Changes In Avionics Industry

Monroe Calculating Machine Co., Orange, N. J., latest acquisition of Litton Industries, Los Angeles, is expected to provide a marketing and service organization for electronic digital computers developed by Litton. The companies merged under a stock exchange agreement approved by Monroe stockholders (AW Oct. 28, p. 63). With other recent acquisitions (Aircraft Radio Corp. and Maryland Electronics), Litton's annual sales are expected to run around $100 million annually.

Other recently announced expansions, mergers and changes in the avionics industry include:

• **Savage Arms Corp.** will purchase Aircraft Armaments, Inc., Baltimore, in a move intended to diversify the former's commercial business. New acquisition employs about 630 people and has specialized in defense work since its formation in 1950.

• **Ryan Aeronautical Co.** will move its avionics section to 30,000 sq. ft. facility on Kearney Mesa, near San Diego. Ryan is in pilot production on Doppler autonavigators and ground-speed indicators for Navy, Army and Air Force.

• **Dalmo Victor Co.** has formed new hydraulics division to exploit developments in this field. R. J. Stahl is manager.

• **Haydu Electronic Products, Inc.** Plainfield, N. J., is adding 15,000 sq. ft. of new facility to existing plant.

• **El-Tronics, Inc.,** Philadelphia, has purchased the Parkchester Machine

ADVERTISEMENT

MICRO-BEARING ABSTRACTS

by **A. N. DANIELS,** *President*
New Hampshire Ball Bearings, Inc.

BEARING FITS AND FITTING PRACTICES

As shown in *Fig. 1*, the fitting of Micro-Bearings, like the fitting of larger ball bearings, chiefly involves the clearances between the inside diameter of the housing and the outside diameter of the bearing; the bore of the bearing and the shaft diameter.

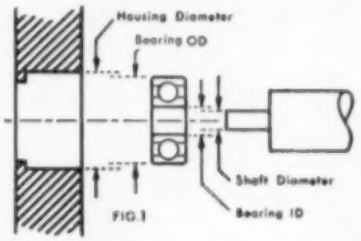

FIG. 1

The achievement of the desired fit by dimensioning is illustrated in *Fig. 2*. The bearing ID is represented by the top blocks and the shaft OD is represented by the lower blocks. Such a block diagram could also be applied to housings and bearing outside diameters. In this block diagram, it will be noted, the bearing ID is represented by a .00015 tolerance with a similar tolerance for the shaft. A resulting fit of line to line to .0003 loose is shown.

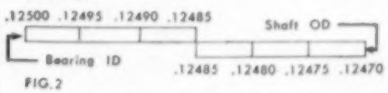

FIG. 2

An interference fit not tighter than line to line is suggested for the following reasons:

1. *Difficulty in assembly.*
2. *Difficulty in disassembly. This is often more hazardous than the assembly operation and may result in total bearing destruction.*
3. *Reduction in radial play.*
4. *Danger of bearing ring conforming to possible poor geometry of mating shaft or housing.*

TOLERANCE DISTRIBUTION

The maximum .0003 loose condition shown in *Fig. 2* may be excessive in some applications. The fitting problem then resolves itself to reducing this extreme, and yet maintain the maximum tight fit of line to line. The looseness may be reduced by redimensioning the shaft to .12490/.12475 as shown in the block diagram, *Fig. 3.*

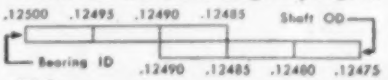

FIG. 3

If the frequency distributions of shaft and bearing ID sizes were statistically normal, the modal fit of all parts would be 0.0001 loose. Accordingly, an insignificant percentage of parts would be mated to the extreme values, and for practical purposes could be ignored.

With regard to bearings' outside diameters and bores, however, normality of the distribution curve cannot be assumed. During the grinding operation, the "most metal tendency" tends to skew the frequency distributions for bearing ID's and OD's in the direction of most metal.

In grinding and finishing shafts and housings, similarly skewed distributions occur.

Operating on a modified probability distribution of tolerance is possible if the volume of parts is sizeable. But the approximate distribution of shaft and housing sizes must be verified if this method is to be used.

MATERIALS and SURFACE FINISHES

The ease of assembly is also affected by materials and finishes. The following factors must be considered:

1. *The galling characteristics, hardness and ductility of the materials involved.*
2. *Finish lay patterns produced by various tools and techniques used.*
3. *R M S surface finish values achieved.*
4. *Geometry of shafts and housings as regards out-of-roundness, taper, etc.*

The possible combinations of these elements in any single application are so numerous that their gross effect can only be ascertained by trial and error, or by a detailed study of operations on individual applications. A more complete discussion of fitting practices, including sizing methods and coding, is found in our design handbook.

DESIGNERS HANDBOOK FREE TO ENGINEERS

If you work with miniature bearings, you'll find this new, 70 page authoritative publication a great help in solving problems in designing instruments or small electro-mechanical assemblies.

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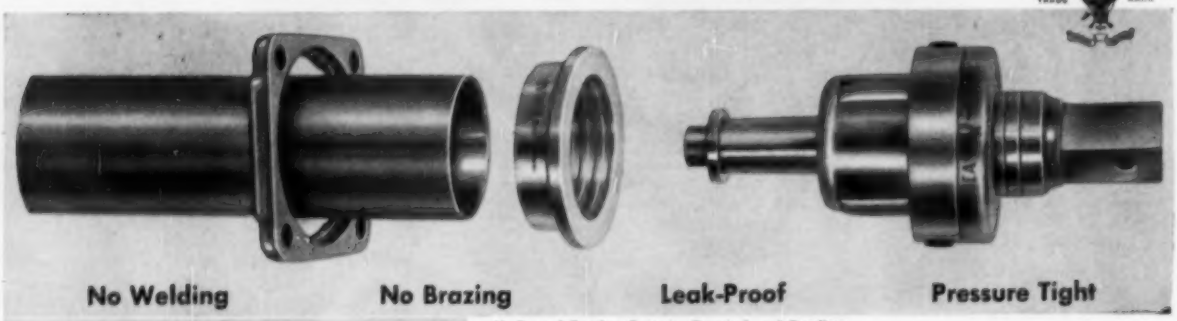
NEW HAMPSHIRE BALL BEARINGS, INC., PETERBOROUGH 1, NEW HAMPSHIRE

AVICA MECHANICALLY ATTACHED TUBE FITTINGS



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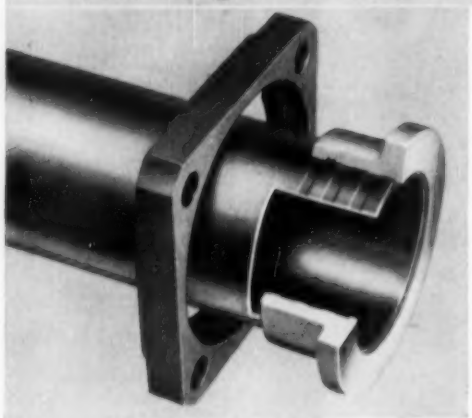
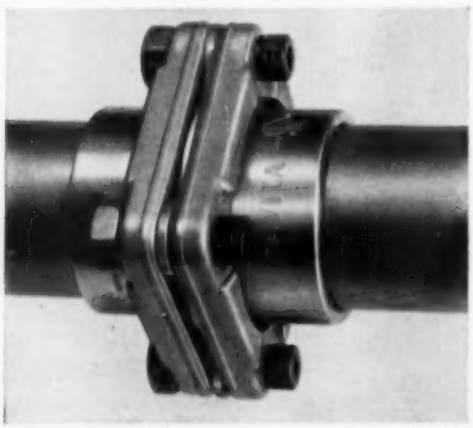


Sectional view of one form of groove configuration illustrates ridges raised on the tube surface which hold the ferrule to the tube.



Completed rigid tube joint made with two AVICA ferrules, gasket and AN756 swivel flange.

AVICA Mechanically Attached **TUBE FITTINGS** can be assembled with **AVICA** installation tools in your own shop to make high pressure leak-proof joints — rigid tube to rigid tube and rigid tube to flexible tubing assemblies — No brazing, welding or X-Ray inspection necessary.

Choice of tubing and fitting materials is no longer limited to weldable grades of aluminum and stainless steel. Full advantage can be taken of the superior strength of non-weldable grades such as 2024 (24ST) aluminum.

All fuels, oils, gases and corrosive liquids can be handled by selecting the most suitable materials for tubing, fittings and gaskets.

Alignment of **AVICA** mechanically applied fittings can be controlled without difficulty due to elimination of distortion on squareness between fitting faces — very close tolerances can also be held on overall assembly lengths.

Write on company letterhead for technical data.

AVICA CORPORATION
P. O. BOX 180, NEWPORT, RHODE ISLAND

ICBM Fueling Tests

Atlas intercontinental ballistic missile fueling operation is simulated by test console to check reactions of typical Air Force airmen who will operate the missile. Test is part of human engineering study by Convair at Strategic Air Command's Riverside, Calif., base.

Corp., New York, producer of electromechanical products. W. H. Hamel, former president of new acquisition, will remain in consulting capacity.

• **Westinghouse Electric** has opened new warehouse for receiving tubes in Dallas at 4819-21 Reading St.

• **Kaiser Industries Corp.** will purchase assets of Kaiser Aircraft & Electronics Corp., wholly owned subsidiary of Willys Motors, Inc., which will be operated as division of the parent company.

• **Raytheon's Missile Systems Division** headquarters will move in November to new 40,000 sq. ft. facility in Waltham Industrial Park on Route 128, near Boston.

FILTER CENTER

▶ **Keep Cool, Live Longer**—New avionic equipment rack with built-in forced-air cooling, installed by United Air Lines on a fleetwide basis, has already begun to pay off in fewer equipment failures. For example, unscheduled removals of navigation receiver in DC-7s has been cut roughly in half, UAL's T. A. Ellison reported at recent Baltimore conference. Forced-air cooling also is expected to reduce flight crew fatigue from radio rack heat and exhaust smoke produced by avionic equipment failure from the cockpit area. Prior to adoption of forced-air cooling, at least one flight crew complained that high ambient temperature created by avionic equipment "caused stewardesses to shorten their visit to the flight deck," Ellison reported.

▶ **Merger, Merger Everywhere**—Two major medium-size West Coast avionics manufacturers are deep in merger talk huddle. If merger goes through, it will come as surprise to many old timers in the business. Combined company would have total annual sales of around $100 million.

▶ **All the Comforts of Home**—Traffic controllers who man the radar consoles of Civil Aeronautics Administration's new air route surveillance radars (ARSR-1), now under construction at Raytheon, will find built-in coffee cup holders and ashtrays.

▶ **Reliability Guinea Pigs**—New test and design procedures which Defense Department hopes to introduce into future development and production contracts to improve reliability (AW Aug. 5, p. 34) will be tried out first by all three military services. Each service will select several new development

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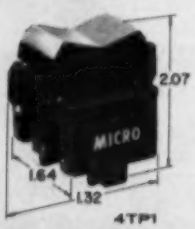


4TP1 Series

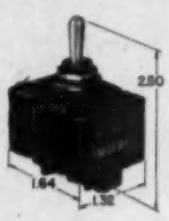
MICRO SWITCH TP Series precision switches are a completely new design. Rocker actuation makes switching easy, yet false or accidental actuation is reduced to a minimum.

The removable actuating rocker is made from either clear or clouded plastic. In the clouded, only the ends are clear. From a light source inside the panel, light from the clear end indicates rocker position which is highly advantageous on control panels. (*Data Sheet 141.*)

LEVER-ACTUATED

1TL1 Series

2TL1 Series



4TL1 Series

MICRO SWITCH TL Series precision switches are for applications which call for unusual reliability and long-life performance.

Toggle levers are of satin chromium-plated brass with sure anti-rotation control. Covers are of die-cast aluminum. (*Data Sheet 139.*)

ELECTRICAL DATA

Catalog Listing	Resistive Load					Lamp Load		Inductive Load	
	30vdc	115vdc	250vdc	115vac	230vac	30vdc	115vac	30vdc	115vac
2TP4-1	20 amps.	.75 amp.	.5 amp.	25 amps.	9 amps.	7 amps.	4 amps.	15 amps	15 amps.
4TP1-1	20 "	.75 "	.5 "	20 "	9 "	5 "	4 "	12 "	15 "
1TL1-1	20 "	.75 "	.5 "	15 "	6 "	5 "	3 "	15 "	10 "
2TL1-1	20 "	.75 "	.5 "	25 "	9 "	7 "	4 "	15 "	15 "
4TL1-1	20 "	.75 "	.5 "	20 "	9 "	5 "	4 "	12 "	15 "

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programs and several equipments about to go into production to serve as guinea pigs. Program is sponsored by James M. Bridges, Director of Electronics, Office of Assistant Secretary of Defense for Research and Engineering.

▶ **Calling All Authors**—The 1958 Electronic Components Conference, to be held April 22-24 in Los Angeles, is seeking prospective authors. Abstracts of proposed papers (100 words), plus background information on author(s), must be submitted by Nov. 15. Send abstracts to: E. E. Brewer, Zone 6-30, Convair, Pomona, Calif.

NEW AVIONIC PRODUCTS

Components & Devices

• **Seven-channel** magnetic-tape recording head, designed for use in missiles, uses 20 microwatts and can be connected directly to thermocouples to record without use of amplifiers. Head

is said by manufacturer to withstand high shock and vibration forces as well as high temperature and thermal shock. Aluminum head features gap alignment scatter less than 0.1 mil, tape guides integral with the head. Manufacturer: Data Storage Devices Co., 7828 Burnet Ave., Van Nuys, Calif.

• **Electronic chopper,** No. 333058, meets requirements of MIL-E-5272A and is said to have a minimum operating life in excess of 5,000 hr. Chopper features zero phase shift, frequency

range from 60 cps. to 20 kc., ambient range from −55 to +125C, measures 2 in. diameter by 1⅞ in. long. Manufacturer: Kearfott Co., Inc., 1378 Main Ave., Clifton, N. J.

• **Ceramic tetrode,** Type 4CX1000A, is a high current, low voltage radial beam tetrode with high gain and a plate

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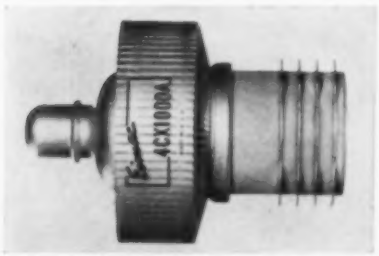
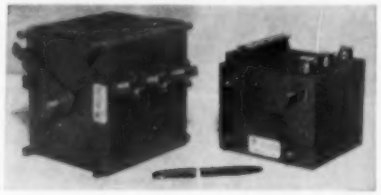


dissipation of 1,000 w. Specifically designed for single sideband operation, tube is a Class AB, r.f. or a.f. linear amplifier. It achieves maximum rated output power with zero grid drive, simplifying driver stage design problems. Manufacturer: Eitel-McCullough, Inc., San Bruno, Calif.

• **High temperature** selenium rectifier, Model 293M1735, especially designed for aircraft use, meets Mil-P-7212B. Rectifier is a 6 phase, full wave unit with a rating of 100 amp. at 28 v., will



operate at 125 C ambient temperature, weighs 5.5 lb. and measures 5 in. x 6 in. x 6 in. Manufacturer: Components Division, International Telephone and Telegraph Corp., 100 Kingsland Rd., Clifton, N. J.

• **Size 15 resolver,** Model 105D2V, has ±0.1% accuracy from −55 to +85C (with amplifier), with tuned impedance of 10,000 ohms. Unit has been designated by Navy BuOrd as Mk. 4, Mod. 1. Write for Bulletin No. 438 from Norden-Ketay Corp., Commerce Rd., Stamford, Conn.

• **Strain gage modules,** Series P-500, containing complete balancing circuitry have been designed for use in aircraft and missile electronic systems. Modules are available in a range of sizes and in rugged commercial models or military

versions meeting Mil specifications. Units will operate at ambient temperatures to 125C and at altitudes to 60,000 ft. Manufacturer: North Atlantic Industries, Inc., 603 Main St., Westbury, N. Y.

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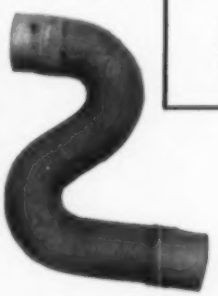
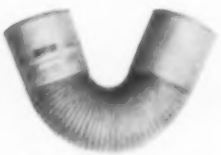


Radome Anti-icing Outlet Duct

Radome Anti-icing Duct Pressure Seal Boot



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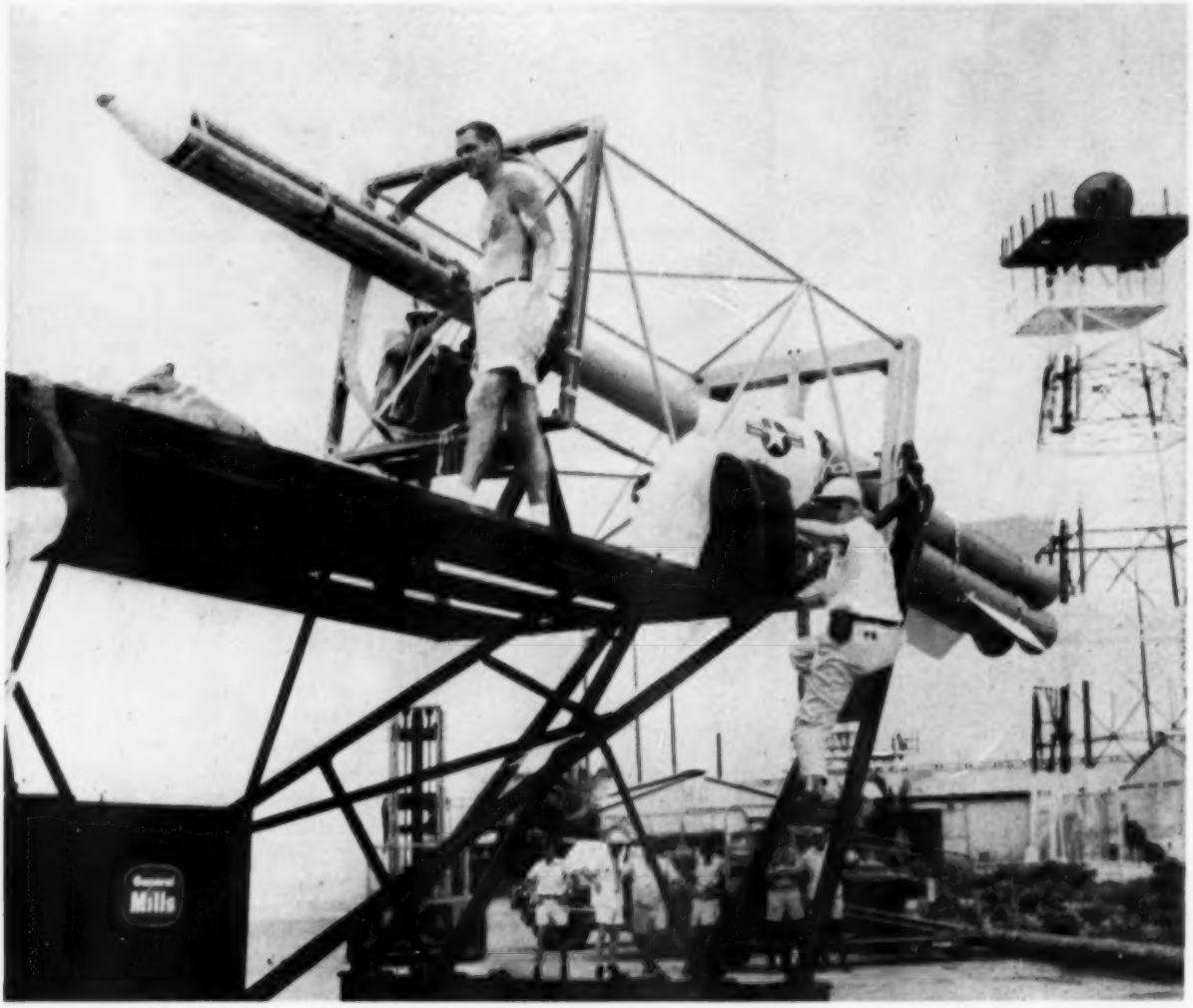
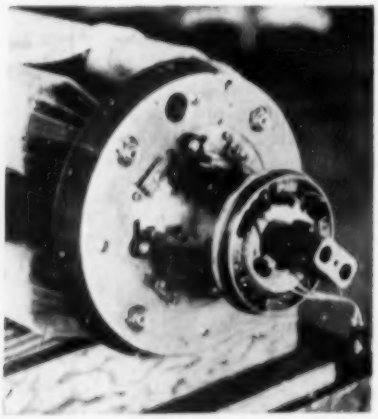
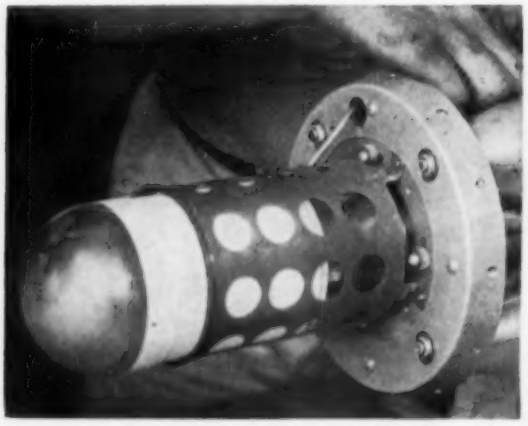


FARSIDE being assembled on its launching truck. Framework from which rocket assembly hangs vertically below balloon can be seen.

Farside Assembled for 4,000-Mi. Flight





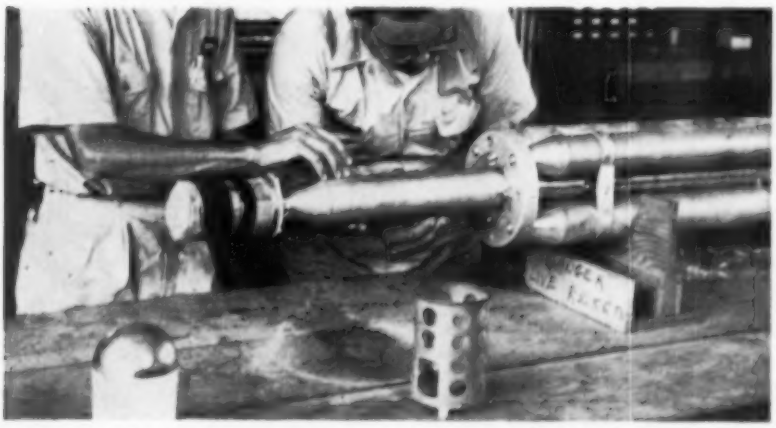
LEFT and middle, two views of the 10 lb. payload and nose cone covering, and right, three of the first stage rockets in place

LAUNCHING truck about to start roll toward the balloon after it is let go.

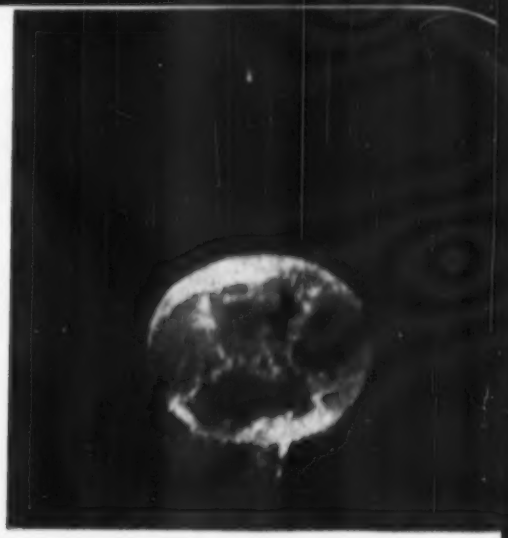
These pictures of preparation and firing of Farside balloon-launched sounding rocket on Eniwetok Atoll in the Pacific show how existing solid propellant rockets were successfully assembled into a 4,000 mi. straight-up data-gathering vehicle. At least one and probably two of the USAF vehicle's fourth stages with their 10-lb. payloads are believed to have reached the 4,000 mi. objective (AW Oct. 28, p. 31). Transmitter failures were reason for altitude uncertainty.

Balloon assist to 100,000 ft. was important since the typically short, fast accelerations of solid propellant rockets—all four stages were burned out in eight seconds—meant that the 25,000 ft./sec. terminal velocity was reached in a short time and the resulting aerodynamic heating of the nose-mounted payload, if launched from the ground, would have been prohibitive.

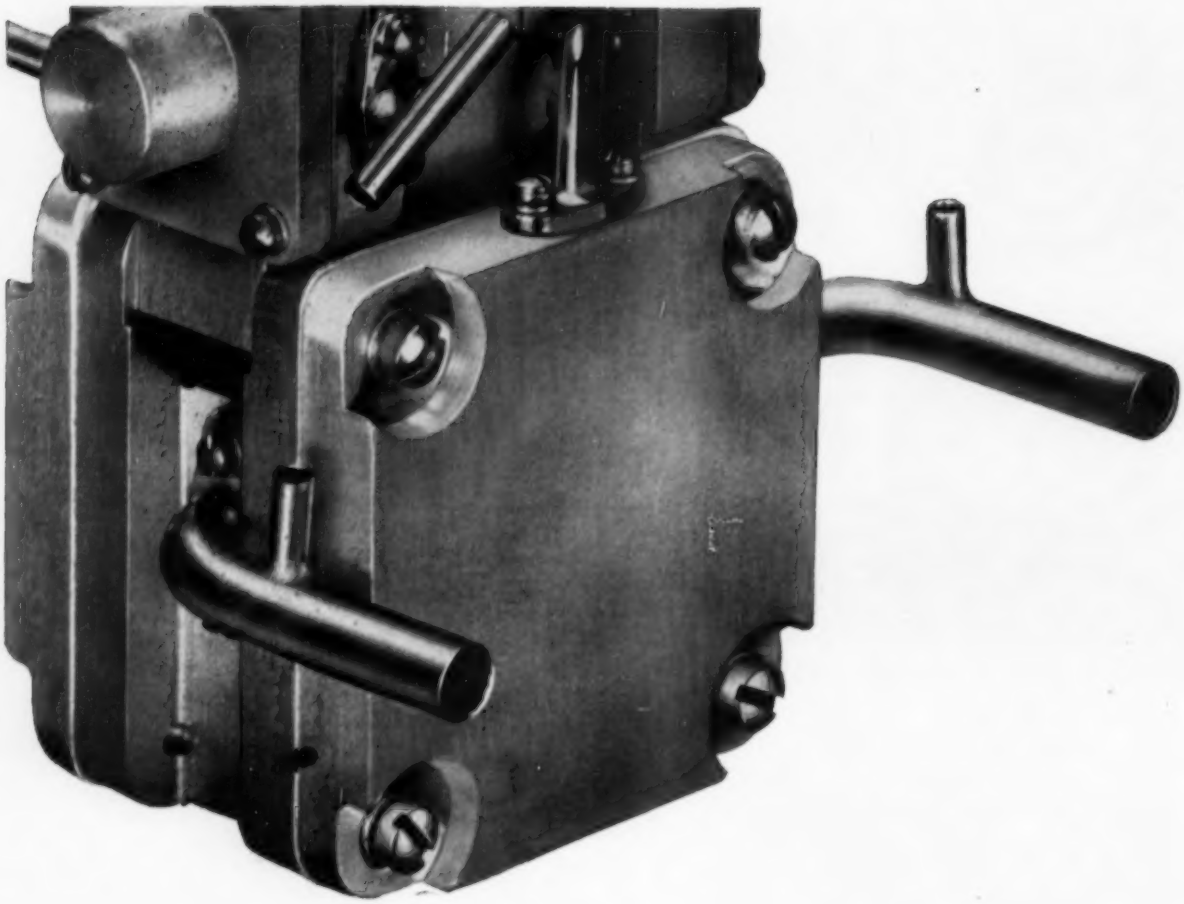
The 30-ft.-long vehicle consisted of four Thiokol Recruit rockets for the first stage, a single Recruit for the second stage, four Grand Central Arrow-type rockets for the third stage and a single Arrow-type for the final stage.



LAST stage rocket, payload on its nose, is slipped between the four third stage rockets.



ROCKET is fired through balloon 70,000-100,000 ft. up. Bottom photo shows rocket's flames below balloon. Middle, 30-ft. vehicle is inside 200-ft. dia balloon. Top, vehicle is 250 ft. above balloon.



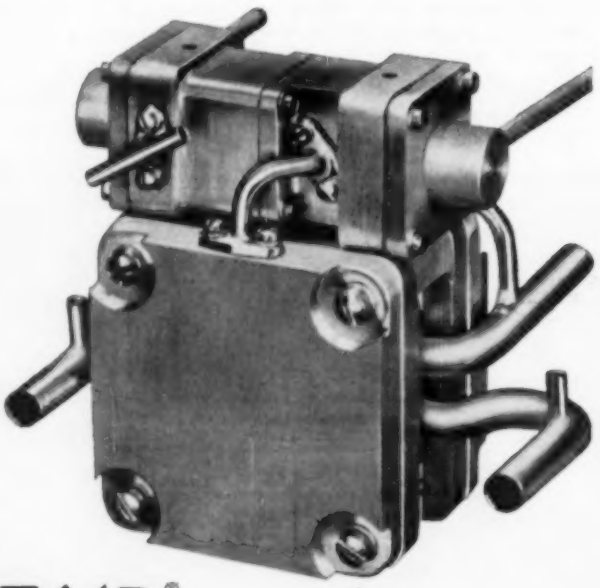
Note: to precision-minded men at RAYTHEON

Transition from manned aircraft to guided missiles can be smooth when you recognize that today's aircraft and tomorrow's missiles have similar functions and require similar controls. Often, a precision control developed for one has application in the other.

Case in point: this Tactair servo amplifier . . . the "intelligence center" of the revolutionary new Tactair T-3 Autopilot. The extreme light weight and high sensitivity of this tiny, completely pneumatic unit give the autopilot superior flight characteristics, 3-axis control, half the weight and cost of conventional types.

Result: a precision control with performance characteristics suited to missile use. Having a primary valve with virtually mass-less components, it converts high-frequency, low-level signals into high-level actuator power . . . produces a true force replica of the minute input signal, even under extremely high and low temperatures. It weighs only 11¼ oz., requires no current, and is small enough to hold in the palm of a hand.

Reminder: on standard or special components, let us assist you with your next precision valve problem. Every job we do is done on a personalized basis. It has been that way for 16 years. Tactair Valve Division, Aircraft Products Company, Bridgeport, Pa. BRoadway 5-1000.



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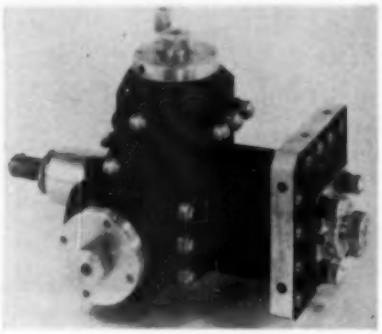
PRODUCTION BRIEFING

Extrusion press of 12,000-ton capacity is now operating at Harvey Aluminum, Torrance, Calif. Part of the Air Force heavy press program, press has overall length of 300 ft., weighs 4,000,000 lb. It can extrude aluminum sections from ingots 32 in. in diameter and 75 in. long.

Ryan Aeronautical Co. will move its avionics activities from company's aircraft plant at San Diego to a 30,000 sq. ft. building at Kearny Mesa, north of downtown San Diego, near new Convair Astronautics Division plant. Entire electronics section of more than 200 employes will move soon to the Kearny Mesa building.

Machine Works, Inc., Gardena, Calif., says that among its other virtues, Thompson hydraulic tracer valve will convert old machines into modern



automatically controlled profiling and contouring machinery. Firm offers a complete installation which it says will speed production and build profits.

Bettinger Corp., Waltham, Mass., expect that the $2.5 million in ceramic coating research in which it has invested in the last 10 years will double its sales to $6 million by 1960. President Robert A. Weaver, Jr., said that the firm has new coating which will protect metals against temperatures of 2,500F and up.

U. S. Steel Corp. says its Duquesne, Pa., works have successfully made large commercial castings by vacuum techniques. To form the vacuum which eliminates harmful gases from the molten metal prior to forming the ingot, a 17-ft. diameter, 30-ft. high vessel is placed over the mold and air is removed by four large pumps. Ingots up to 95 in. in diameter and 360,000 lb. may be cast this way, according to U. S. Steel. The company said that in addition to generator and turbine shafts for the electrical industry, the process would be applied to parts for high speed aircraft.

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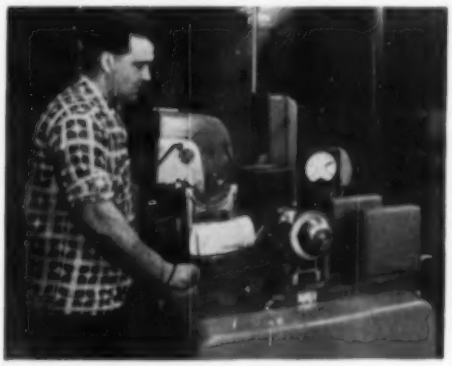

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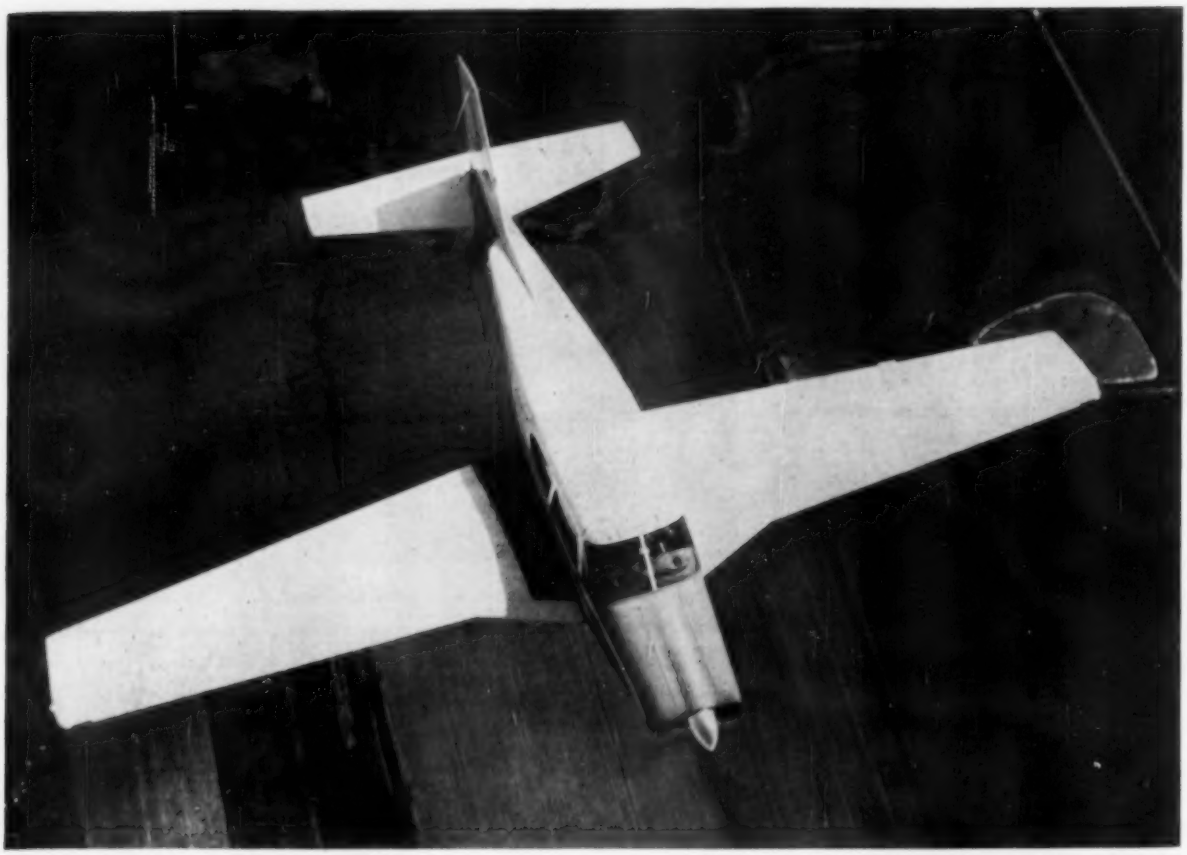
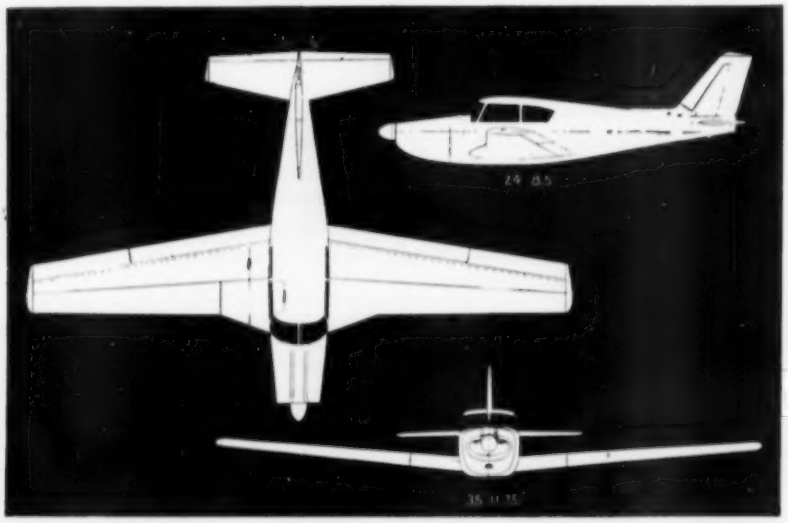


LAMINAR-FLOW low-drag airfoil section gives Comanche good speed, range on only 180 hp. Later 250-hp. version will be 25 mph. faster.

Aviation Week Check Flight:

Comanche Shows Stability, Ruggedness



BROAD FUSELAGE gives Comanche a cabin measuring 44½ in. wide, baggage compartment with 20 cu. ft. of space. Long-span flaps are some 10% larger than twin-engine Apache.

By Robert I. Stanfield

Lock Haven—New four-place, single-engine PA-24 Comanche is a stable, comfortable, high-performance airplane with the same easy-to-fly characteristics as its Piper forebears, AVIATION WEEK found in its flight evaluation.

Company keys performance of the low-wing, all-metal airplane to:

- **Laminar-flow** wing section, developed by National Advisory Committee for Aeronautics (AW June 11, 1956, p. 109).
- **Horizontal stabilator,** a single-piece, jet-type surface hinged at about 30% of mean chord that moves in its entirety.
- **Four-cylinder Lycoming** O360-A1A engine which develops 180 hp. at 2,700 rpm. at takeoff.

Engine compression ratio is 8.5 to 1; fuel grade is 91 octane. Engine is equipped with cross-over exhaust system developed by Piper. System pro-

COMANCHE SITS CLOSE to ground permitting easy access to cabin without auxiliary step to wing. Dihedral measures five degrees.

vides scavenging of exhaust gases for maximum power on takeoff. Stainless steel exhaust muffler is provided.

Standard equipment includes constant-speed, controllable propeller which, in the case of the demonstrator, was manufactured by Hartzell. Some models will come equipped with the 4-lb.-lighter McCauley propeller.

Rugged and Low

Ruggedly built airplane is designed to withstand ultimate load factor of 7.5Gs. Airplane sits low, allowing for easy step-up to cabin and easy maintenance of airframe and engine. Height from ground to trailing edge of wing, for step-up, is but 18 in.

Big cabin door—36 in. wide x 33 in. high—makes for easy access to airplane. Roomy cabin is 44.5 in. wide. Rear seat has adjustable seat back. It can be quickly removed to supplement baggage area. Baggage compartment, 20 cu. ft., is aft of rear seat and is reached through separate outside door measuring 20 in. x 22 in.

Front cabin seats are 4.5 in. apart and can be adjusted over range of 6 in. Cabin height, floor to headlining, is 46.5 in. Seats are big, comfortable, tending to lessen fatigue factor during long flights.

Preflight and Starting

Aircraft was picked up at New York for cruise to Lock Haven, Pa., where further flight evaluation was conducted. Custom Comanche used for evaluation was first production model, N5000P. Dry weight of airplane is 1,445 lb. With about 40 gal. of fuel, 8 qt. of oil, 40 lb. of equipment and three people plus light luggage aboard, airplane grossed about 2,280 lb. Maximum allowable gross weight of Comanche is 2,550 lb., useful load is 1,105 lb.

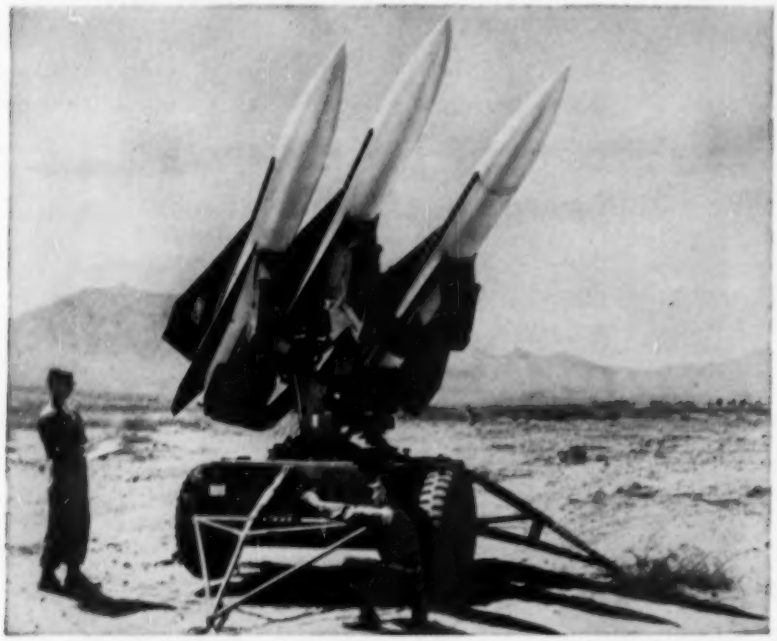
Wind was from the south, 16 to 20 kt., and sea level pressure was 30.08 in. (1019.0 mb).

Preflight and starting procedures are simple. Permanent checklist for takeoff

CUSTOM MODEL instrumentation has full gyro layout for instrument work; Super Custom will have Lear ADF-12E and Narco Mk. 2 Omnigator. Panel face is vacuum-formed plastic.

TAIL GROUP features one-piece "stabilator" flying stabilizer having adjustable anti-servo tab to provide control feel and balance. System requires about 20% less area than a conventional horizontal tail, Piper reports. Rudder was swept to give plane modern look.

ENGINEER OPPORTUNITIES AT RAYTHEON



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and landing is located at top of nosewheel well, beneath center of instrument panel. Instruments, spread over wide, shock-mounted panel, and dual flight controls, are accessible to both pilots. Switches run across bottom of panel beneath which, on pilot's side, are located circuit breakers.

Engine quickly fired up after one prime shot. Engine instruments went right to the green—oil pressure, fuel pressure and oil temperature.

Cockpit visibility is good to all sides. Unusually wide tread of gear, 9 ft. 9.5 in., coupled with large nosewheel—all wheels, main and nose, are equipped with same size 600 x 6 tire—made taxiing light and smooth.

Airplane was taxied away from strip and rolled easily across rough surface area with little jouncing evident. Braking action was non-grabbing. Cleveland single-disk hydraulic brakes are operated by single hand brake that hangs down from left instrument panel.

Light pressure was required to activate nosewheel which, when extended, engages with rudder pedal system. Nosewheel travel runs 25 deg. left or right. When gear is retracted, linkage automatically disengages to lighten rudder load.

Before takeoff elevator trim was adjusted, via overhead tab handle. And rudder trim knob, located on right side of nosewheel housing was run to extreme right to counteract takeoff torque effect. Auxiliary electric fuel pump, used for takeoff and landing, was switched on.

Standard takeoff was made with no flaps and full power. Airplane went smoothly down runway with minimum of rudder control. At 60 mph. nosewheel broke ground and Comanche was airborne within 700 ft.

Gear retracted quickly, within seven seconds and airplane climbed out effortlessly at 95 mph. IAS. Rate of climb was 1,100 ft. per min., pulling 28 in. MP and 2,500 rpm. PA-24 trimmed out neatly. Rudder trim easily compensated for torque. Despite climb angle, visibility remained good.

Mixture Control

Manual leaning was accomplished during climb, with mixture control being retarded until engine ran rough, then advanced until smoothness was restored. While leaning is most effective at 5,000 ft. and above, application at lower altitudes allows for lesser fuel consumption and still won't starve engine.

At 5,000 ft., pulling 25 in. MP and 2400 rpm., holding 95 mph. IAS, rate of climb was 700 ft. per min. Airplane was leveled off at 8,000 ft.

With power reduced from 75% at cruise altitude—22 in. MP and 2400

rpm.–Comanche held 160 mph. TAS. Stability during climb and cruise was excellent; little trim application was necessary.

Flight to Lock Haven was smooth and comfortable. Hanging rudder pedals, which leave floor clear, give ample leg room for "stretching." Airplane requires little control pressure during flight. Soundproofing made easy conversations possible.

Comanche's good flight characteristics are attributed to laminar flow wing and "flying tail" or stabilator. Latter consists of single-piece horizontal surface that moves in its entirety when control wheel is moved fore and aft. Self-compensating anti-servo tab extends nearly full length of trailing edge and can be adjusted in flight to compensate for loading variations.

Horizontal stabilizer area–32.5 sq. ft –is 20 to 25% less with stabilator than with conventional surfaces, according to Piper's chief design engineer, Fred Strickland. Ratio of movement between stabilator and tab is 1 to 1.5. Piper can change ratio of movement to get any control forces it wishes to build in.

Cruising Range

During flight, which entailed intermittent maneuvering and varied power applications, fuel consumption averaged 10 gal. per hr. Fuel is carried in two 30-gal. rubber fuel cells in each wing. Standard fuel supply is 50 gal. for normal four-place operation. For additional range, 10 extra gal. can be carried through filler neck which extends about one in. into the tank.

When cells are filled to bottom of filler neck, each tank holds 25 gal. When filled to the top, each holds 30 gal.

Piper lists the following 8,000-ft.

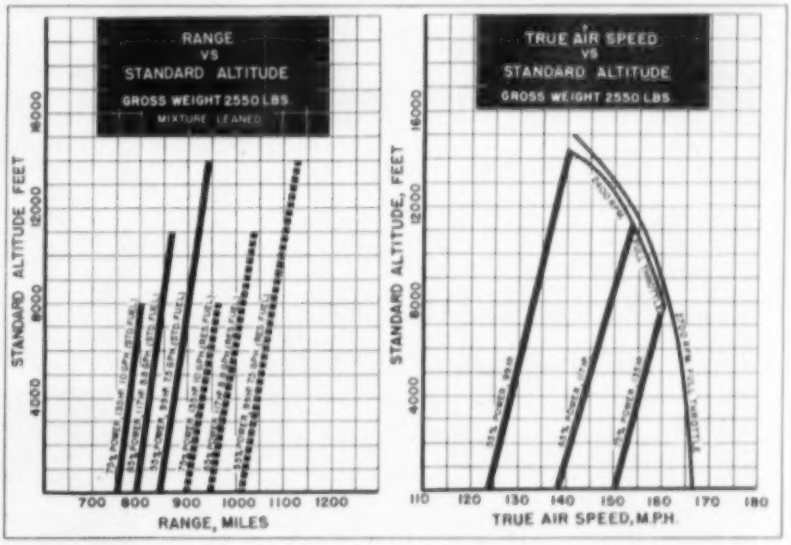
Piper Comanche — Model PA-24

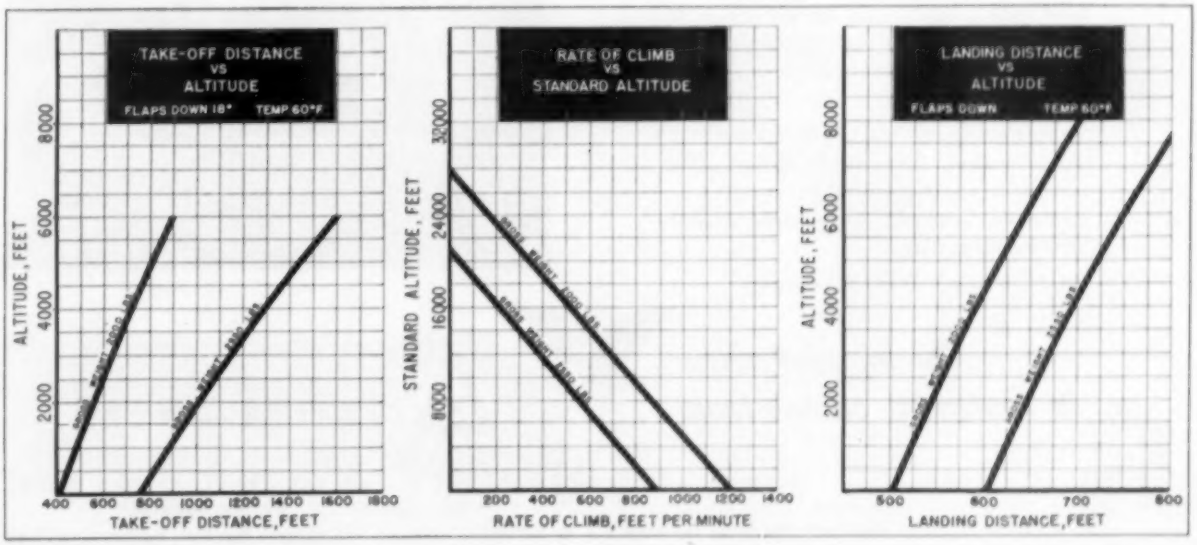
SPECIFICATIONS

Engine	Lycoming O360-A1A
Hp. and rpm	180 @ 2,700
Gross weight (lb.)	2,550
Empty weight (lb.)	1,445
Useful load (lb.)	1,105
Wing span (ft.)	36
Wing area (sq. ft.)	178
Length (ft.)	24.7
Height (ft.)	7.3
Power loading (lb./hp.)	14.2
Wing loading (lb./sq. ft.)	14.3
Baggage capacity (lb.)	100
Fuel capacity (standard, gal.)	50
Fuel capacity (with reserve fuel, gal.)	60

PERFORMANCE

Top speed (mph.)	167
Optimum cruising speed (75% power, 8,000 ft., mph.)	160
Stalling speed (flaps down, mph.)	58
Takeoff run (ft.)	750
Landing roll (flaps down, ft.)	600
Best rate of climb speed (mph.)	96
Rate of climb (fpm.)	910
Service ceiling (ft.)	18,500
Absolute ceiling (ft.)	21,000
Fuel consumption (75% power, gph.)	10
Cruising range (standard fuel, 75% power, 8,000 ft.)	5 hr., 800 mi.
Cruising range (standard fuel, optimum)	6.2 hr., 920 mi.
Cruising range (reserve fuel, 75% power, 8,000 ft.)	6 hr., 960 mi.
Cruising range (reserve fuel, optimum)	7.5 hr., 1,100 mi.





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NAS 2806	⅜-24
NAS 2807	7/16-20
NAS 2808	½-20
NAS 2809	9/16-18
NAS 2810	⅝-18
	¾-16
	⅞-14
	1-12

2. Adaptable to all heads (with weight savings, too)

The flat fillister and button head configurations shown here are two examples of additional head styles available in a full range of sizes. The small heads also offer important weight savings . . . for example, the ¼-28 flat fillister head with a head height of .150 and a .375 diameter will accept the TORQ-SET design and deliver driving torques far in excess of requirements.

What's more, you get in TORQ-SET a single design in wrenching and tooling for *all* aircraft applications from the smallest electronic component to the most critical structural location.

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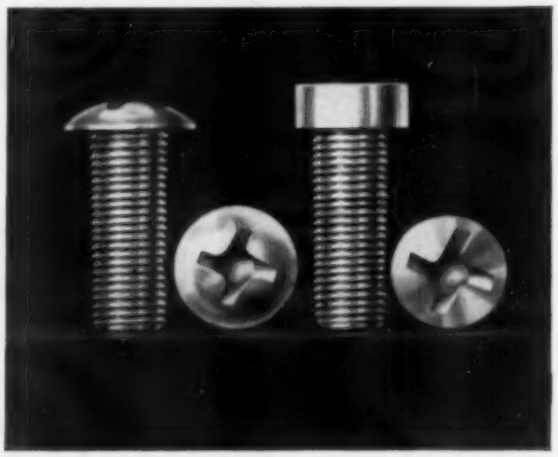

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cruising range figures for Comanche:

- **Standard fuel** (50 gal.), 75% power–800 mi. or 5 hr. flying.
- **Standard fuel,** economy cruise–920 mi. or 6.2 hr. flying.
- **Reserve fuel** (60 gal.), 75% power–960 mi. or 6 hr. flying.
- **Reserve fuel,** economy cruise–1,100 mi. or 7.5 hr. flying.

Fuel selector valve is on floor between pilots' seats and may be checked visually or by feel. Fuel flows by gravity from tanks to gascolator, behind co-pilot's seat, low spot for drainage. Pressure from main tanks brings fuel to firewall where pumps take over.

During cruise flight at 8,000 ft. power was reduced to 19 in. MP and 1,900 rpm. Indicated speed decreased slowly due to cleanness of airplane and finally held constant at 120 mph. With setting of 15 in. MP and 2,200 rpm. speed held at 110 mph. indicated.

Stability and control characteristics remained good during slow flight. Piper again attributes this to aerodynamic feature of laminar flow wing.

Power-on stalls were accomplished at 8,000 ft.

With 15 in. MP, 2,200 rpm., gear and flaps up, airplane was pulled nose high. Comanche buffeted well ahead of stall; break came about 62 mph. IAS. Using standard recovery procedures, maximum loss was less than 200 ft.

At same power setting, gear down and no flaps, and gear down with full flaps, airplane stalled out at 65 and 55 mph. IAS, respectively. In each instance there was early pre-stall buffeting and almost a reluctance of the airplane to let go. Lateral stability was excellent, slight rudder pressure compensating for minor falling off of wing.

Power-Off Stalls

Dropping down to 6,000 ft., same series of stalls was accomplished with power off. With gear up, horn blows and red warning light comes on when power is reduced to 10 in. MP.

With gear and flaps up, airplane stalled at 63 mph. IAS. Gear down, with no flaps and full flaps, stall speeds were 60 and 58 mph. indicated, respectively. At all configurations recovery was initiated with negligible loss of altitude.

Holding airplane nose high, gear and flaps down, we deliberately entered a series of stalls, breaking from one and falling into the other, without applying power.

Airplane porpoised along, losing altitude as it went, but retaining lateral stability at all times.

"Final approach" stall, emphasizing safety aspect of airplane, was entered with airplane in landing configuration, Gear and flaps were down, power set at 15 in. MP and 2,200 rpm. Airplane was pulled into 30 deg. bank, nose high, and tight turn initiated. Advance pre-stall buffeting again occurred well ahead of stall and recovery was made with only 60 ft. loss of altitude.

Quick Descent

Though Comanche is redlined at 203 mph. it does not tend to build up excessive, dangerous speed in descent. To get down in a hurry from 6,000 ft. we dropped gear and full flaps. With throttle back and rpm. at 2,200, rate-of descent was 2,000 fpm. Indicated airspeed was but 110 mph.

Prior to landing, airplane was slowed to 90 mph. on base, and flaps were extended one notch, about 9 deg. Flaps have three extended positions–9, 18 and 27 deg.–with full flaps recommended for landing.

With speed reduced to 85 mph. on final, airplane control and stability remained good. With full flaps and trim applied, airplane descended smoothly. Wind was negative, and slight lift was encountered over the fence. After floating a bit, airplane settled nicely and was brought to stop in slightly over 600 ft. from touchdown, using minimum of braking action.

Short-field takeoff was initiated with 18 deg. of flaps extended. Second flap position got airplane off ground at

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This Airwork Inspector is electronically checking the surface finish on a cylinder wall with a profilometer. This device registers the microscopic roughness of the cylinder walls—an important factor in controlling oil consumption throughout the life of the engine.

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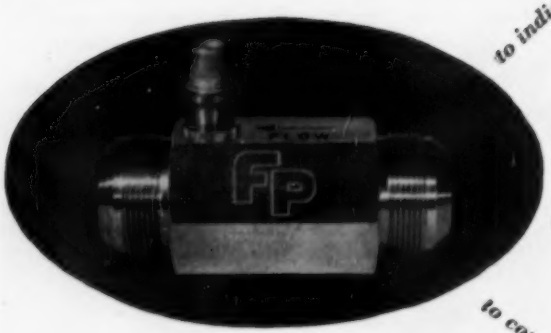
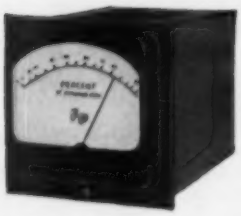


to indicate flow

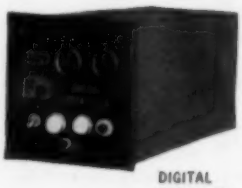


PANEL FLOW RATE INDICATOR

to indicate steady state flow condition

IN-LINE DIGITAL INDICATOR

to totalize flow for batch processes



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For complete data on the F&P turbine meter and some of the systems it makes possible, write for catalog. Address request to Fischer & Porter Co., 5217 County Line Road, Hatboro, Penna.

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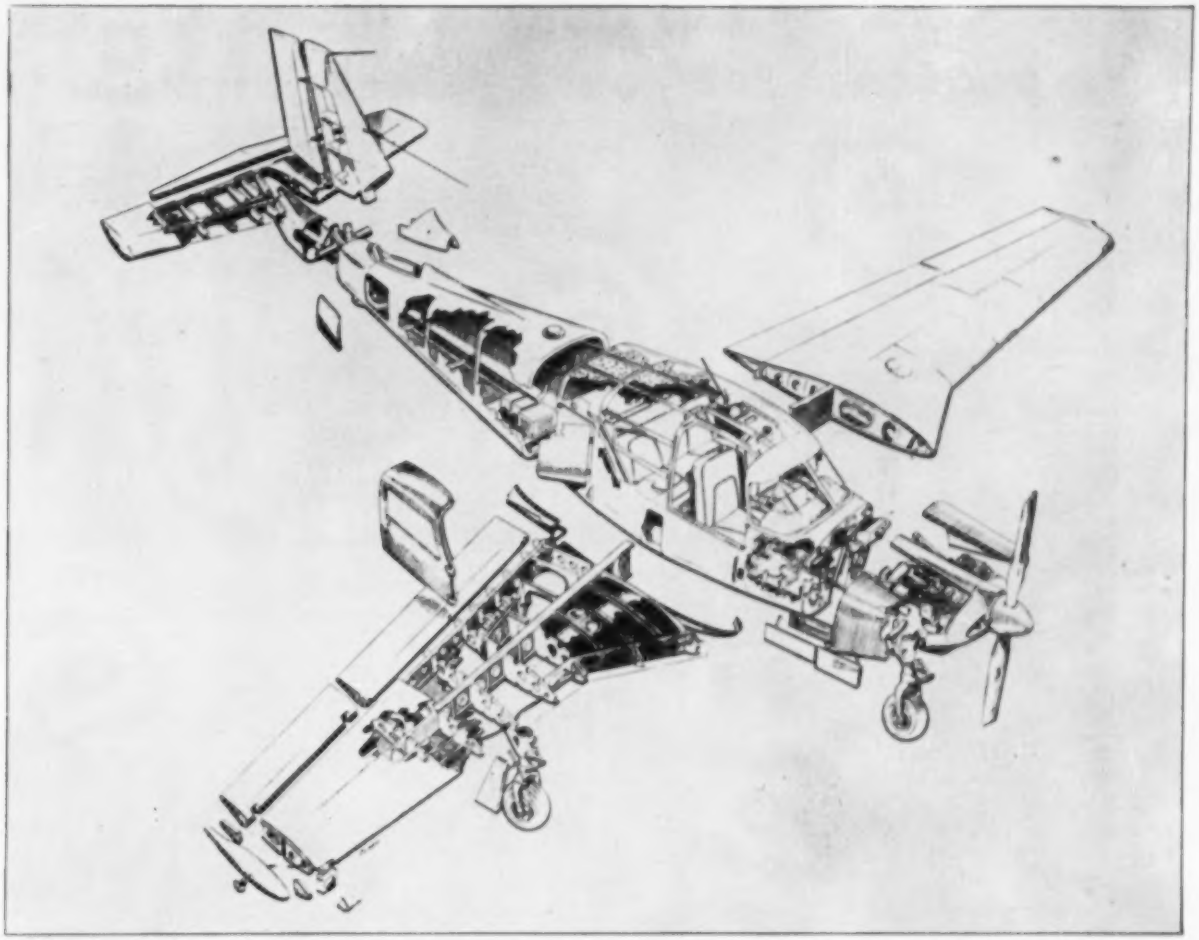

COMANCHE AIRFRAME is stressed for 7.5G load factor. Large main spar passes through cabin at floor level and is spliced under rear seats. For production economy, few skin parts are formed. Engine mount, nose gear loads are passed through beams in fuselage.

about 60 mph. in about 500 ft. Little fall-away was evidenced when flaps were raised after takeoff.

Because airplane sits low to ground, tendency on landing is to level off on high side. With no wind, or slight wind from the rear, as we encountered during evaluation, floating tendency is developed which, of course, eats up runway. Until familiarity with landing characteristics is gained, quicker touchdown can be accomplished through reduced flap extension.

Wide gear holds airplane snug to ground. Safety switch located in left main, activated by weight of airplane, prevents gear collapse on ground should gear handle be accidentally flipped.

Emergency Extension

In the event of electrical failure in flight, gear may be extended mechanically.

This is done by lifting floor plate and disengaging gear motor. Telescoping gear lever, located on floor between pilot's seats, is then extended to full length and moved full forward. Gear will drop into full down position.

Gear cannot be checked visually in flight. However, in addition to horn and light, one may visually observe slow forward or aft movement of floor-based emergency gear lever which travels in direction gear switch is flipped. Pilot also can "feel" the locking of gear as it falls into place.

Three Models

Comanche, as is the rest of the Piper line, is offered in three models: Standard, Custom and Super Custom. Difference lies in equipment installed. Standard model is priced at $14,500 without radio equipment or basic flight instruments.

Custom Comanche has Narco Superhomer with VOR navigation unit, VHF receiver and 12-channel transmitter with nine crystals as standard, low frequency receiver with separate power supply, headset mike and two antennas, plus following flight instruments: artificial horizon, directional gyro, electric turn and bank, rate of climb, clock, outside air temperature gage, vacuum pump drive and vacuum pump.

Super Custom Comanche has all equipment of Standard and Custom, plus Narco Omnigator Mk. II VOR ILS, VHF unit with 27 channel transmitter, 24 crystals standard, in place of Superhomer and low frequency receiver, and Lear ADF-12E (automatic direction finder). This model would gain about 20 lb. in radio weight over Custom.

Electrical provisions embrace a 12-v. system with 33 amp. hr. battery mounted in firewall for easy access. A 35 amp. generator is standard equipment with optional 50 amp. generator offered. Included are instrument panel lights with rheostat, cabin speaker and headphone and mike jacks.

Standard lighting includes navigation, instrument, and front and rear cabin dome lights, plus a landing light mounted at extreme end of each wing.

Landing Lights

Wing-tip landing-light setting affords these advantages:

Better performance, comfort and appearance for your business airplane!

CONVAIR 240 INTEGRAL STAIR DOOR, *an AiResearch modification, combines high efficiency with light weight and smart appearance.*

INSTALLATION OF WING TANKS *by AiResearch brings capacity to over 2000 gallons, adding extra hours to range of Convair 340 and 440. (Added fuel capacity also available for Convair 240.)*

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Four cabin ventilators provide each passenger with separate sources of outside air. Each has a click-stop dial which regulates amount of incoming air and direction of flow. Cabin heater and defroster, cigaret lighter, four ash trays and coat hooks also are standard equipment.

Airplanes run in standard color combinations: white with blue, red or brown. Interiors are styled in two-tone motif, using washable Try-lock as main upholstery material.

Piper expects to run Comanche production to one aircraft per day in December. There were four production models and two prototypes flying at this writing.

Within the year, company expects to be out with the first production model of its 250-hp. Comanche. (AW Nov 26, 1956, p. 95.) Power will be supplied by Lycoming O-540 six-cylinder engine. Airplane is expected to be 25 mph. faster than the 180-hp model.

Piper official stated that the 1959 Comanche will gross about 2,800 lb., compared to present 2,550. Company expects present airframe to take extra weight and speed of new engine with only slight modifications necessary.

Structurally, the Comanche is designed for high-volume production—the company expects to turn out five airplanes a day eventually—and also for ease of maintenance in the field. A prime objective was to develop a good basic airframe with a long sales life. One official told AVIATION WEEK that he believes there is probably a market for, between 5,000 and 10,000 Comanches during the airplane's production life.

As regards production, the airplane is completely new and has nothing interchangeable with previous Piper aircraft.

An indication of Piper's plans to produce large quantities of its new four-seater is extensive use of forgings in place of castings—the opposite of what was done in the Apache. Company has

Czech Heli-Baby Exhibited at Prague

Ultra light Czech helicopter, designated the HC 2 Heli-Baby, taking part in an engineering exhibit, lands on the roof of a storehouse in Prague (above). Two seat helicopter, designed by a group under Jaroslav Slechta at the Research Institute of Aviation, has a top speed of 75 mph., range of 111 mi. (AW Sept. 3, 1956, p. 79).

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New Travel Air Line Gets Rolling

First photo of Beech Aircraft Corp.'s production line for its new four-place light twin Travel Air business plane shows some of the aircraft in final assembly just across the aisle from the company's four-place single-engine Bonanza (right). First Travel Airs are scheduled to go to customers in 1958, with price for basic airplane being $49,500. Addition of new model will give Beech Distributors a line of four business aircraft, of which three—Travel Air, Twin-Bonanza and Super 18—are twin-engine types.

found that on large volume output, initial higher cost of forging dies is more than offset by being able to amortize this expense compared to continued cost of X-raying castings. Piper says that the reason for use of castings in the Apache was that the company never expected to build as many of these airplanes as it has. Piper has already produced 1,200.

Location of Forgings

Forging are employed in the landing gear housing, gear attachment point in the wings, balance weight to which stabilator control cables are attached and T-shaped fitting over the stabilator control tube. Nose gear drag link is a no-draft forging that requires only drilling of four holes to attach to the fuselage. All aluminum forgings are supplied by Kaiser Aluminum.

Fuselage comprises three major assemblies: forward portion comprising cabin and baggage compartment, made in upper and lower sections, and a single-piece aft fuselage tipped by a separate tail cone.

Lower forward fuselage section contains the structural heart of the airplane. Two heavy longitudinal beams of flat sheet stock run from the firewall back on either side of the nosewheel well, decrease in height to pass under the main spar and increase in height again to the rear of the baggage compartment. These beams take aft landing gear loads from the nose wheel and provide the lower fuselage with good bending stiffness, also act as a keel to absorb belly loads in event of a wheels-up landing.

Another pair of constant thickness flat stock hat section beams run from the upper firewall back along the sides of the fuselage, jogging up at the rear seats and straightening out over the baggage compartment. These are continuous from the firewall to the front of the baggage compartment—a splice carries to the rear of this section. Beams handle engine mount bending loads, also relieve main bending loads incurred by window and door cutouts in the upper portion of the fuselage.

Sections Easily Repaired

Rear section of the fuselage is comprised of conventional formers attached by non-continuous stringers. Rear and forward fuselage assemblies are attached simply by riveting forward fuselage skin overlap to rear fuselage skin. Such makeup makes it possible, in event of extensive damage to rear of the fuselage, to replace whole sections here by removing attaching rivets and without having to cut through major fuselage structure.

Skinning is done with relatively small area flat stock—only formed skin sections in the entire airplane are the cockpit dome, tail cone, engine cowl and wing tips. Basic skin is .025, although under the fuselage, between the spars, thickness increases to .051.

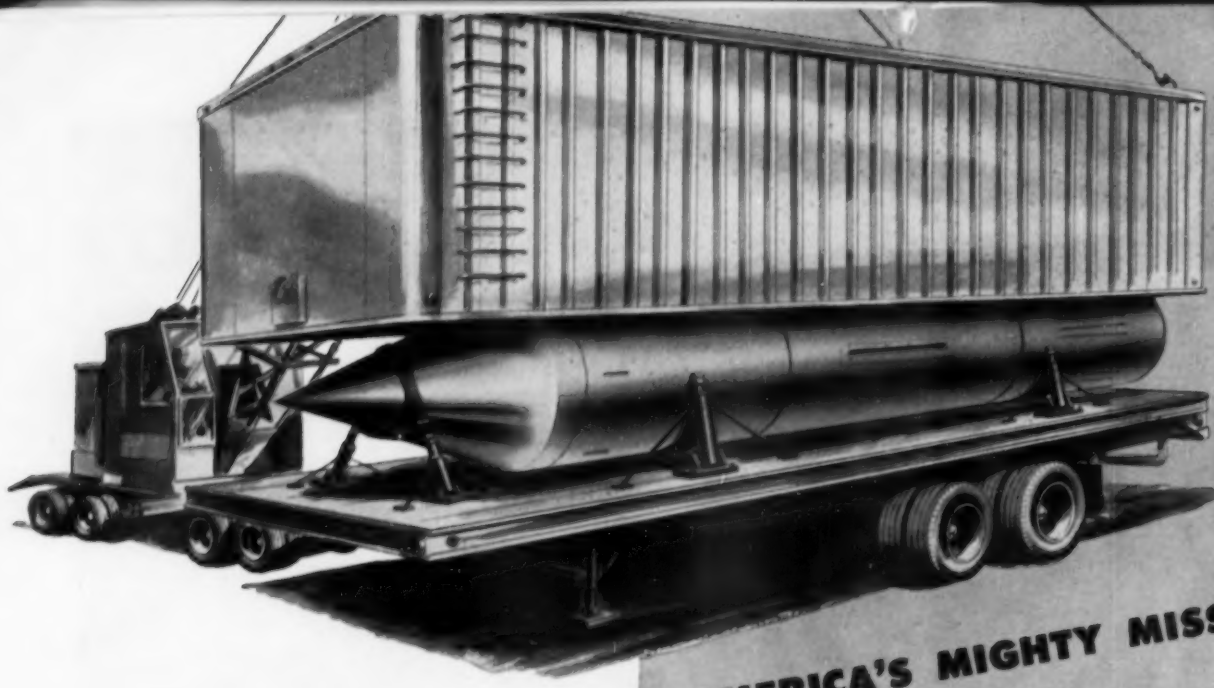
Tapered wing is a low-drag laminar-flow configuration utilizing National Advisory Committee for Aeronautics 642A215 airfoil section throughout. Main spar uses identical top and bottom extrusions as spar caps out to about two-thirds of the span, conventional channel sections out to the tips. Stringers, cut in 12-ft. lengths, are bulb section.

Wing Assembly Technique

Wings are assembled in forward and rear section jigs. Skin is wrapped around the nose section and fastened to the main spar cap strip with holding rivets. When forward and rear sections of wing are assembled, rear skin is slipped under the front skin and structural riveting is done through the skins and spar caps. Technique frees nose and rear wing section jigs to turn out assemblies, with final jig used to tie all sections together.

Wing is flush riveted as far back as the main spar which is about 45% of the mean chord.

Main wing spars pass through and hang from castings on the sides of the fuselage, butt together under the rear seats and are jointed with top and bottom splice plates to form a continuous spar from wingtip to wingtip. Front and rear spars have fittings built up of flat stock. There is a triangular tubular



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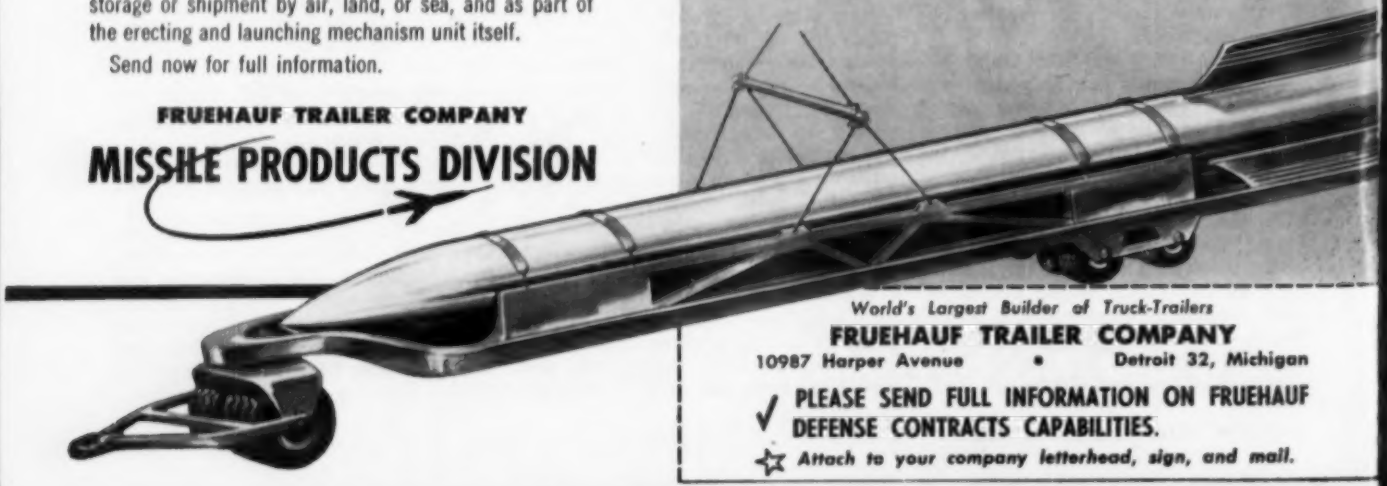

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Fiat G-49 Makes American Tour

Fiat G-49 trainer, shown here at LaGuardia Airport, has made a 28,000 mi. good will tour of North and South America. Two 126 gal. wing tanks were added for the trip. The aircraft also has ventral and dorsal fins. Pilot is Cmdr. Maner Lualdi.

truss structure connecting main spar to a fuselage carry, through structure as the rear spar to dissipate wing rotation loads on the main spar. Wing skins vary from .051 at the roots to .025 at the tips.

To facilitate field maintenance, the landing gear orifice tube assembly and main strut and fork assembly are interchangeable in all three positions, main and nose gears. Main gear scissors assembly is interchangeable on the main landing gears only. Liners can be changed on the Cleveland brakes without having to disconnect hydraulic lines and bleeding fluid.

Interchangeability is also possible with both ailerons—only requirement is that the two-pound balance weight arms are reversed in the course of a switch-over.

Two Ocean Crossings Made by Piper Apache

Piper Apache light twin recently completed a 22,000-mi. tour of Europe, the Middle East, Africa and South America, during which the airplane crossed the North and South Atlantic. According to pilot Dan Walcott, Jr., the trip was made without touching the airplane except to fill the tanks and make one oil change.

Walcott was accompanied on the trip by his wife—except for the ocean crossing, which she made by scheduled airliner so that extra fuel could be carried in the Apache—and Frank Emmert, Coca Cola executive, a non-pilot. Trip took just under three months to complete and totaled 140 flying hours, of which approximately 15% was on instruments.

Auxiliary tankage gave the plane a 20-hr. range on ocean crossings.

North Atlantic flight from Gander to Shannon, Ireland, was made in 14¼ hr. bucking headwinds all the way; the South Atlantic crossing took 13 hr. via Dakar, Senegal to Recife, Brazil. Navigation and communications equipment included a Lear ADF, Sunny South long-range radio, and Narco Mk.11 Omnigator and Simplexer.

PRIVATE LINES

"Aviation Alphabet Scoop" is 48-page booklet explaining 2,300 aeronautical abbreviations. Available from Lear, Inc., 3171 S. Bundy Drive, Santa Monica, Calif.

L. B. Smith Aircraft Corp. opened a "million-dollar" 80,000-sq. ft. facility at Miami International Airport for overhaul and modification of business, airline and military aircraft and equipment. Firm now employs 1,800 and has an annual payroll of $8,725,000. It started operations in 1947.

Three-cylinder two-stroke radial engine, developed for light aircraft and helicopters, reportedly weighs 24 lb. and develops 28 hp. with 21 cu. in. displacement. Powerplant has been engineered by W. C. Johnson, 6631 Elgin St., Los Angeles.

Okanagan Helicopters, Ltd., Vancouver, B.C., has added a Bell 47J helicopter to its fleet of 26 Bells and 18 Sikorskys. Model 47J incorporates an extra window in the lower right-hand corner of the right door, to permit easier downward surveillance while on pipeline surveys.

Crash Injury Research Division of Cornell University, formerly at La Guardia Airport, N. Y., has leased space at Sky Harbor Airport, Phoenix, Ariz., to be closer to the major airframe manufacturers on the West Coast.

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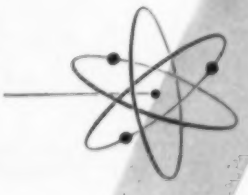

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Dwindling Aircraft Market Caused Production Halt of Cessna's 620

Wichita—Dwindling market caused by airlines' moves to dispose of large numbers of piston engine aircraft in preparation for jet transports (AW Sept. 2, p. 37) was major factor in decision by Cessna Aircraft Co. management to cancel further work on its Model 620 four-engine pressurized business plane.

Development Cost Rose

Cost of developing the airplane to meet Civil Aeronautics Administration part O4B transport category requirements also were higher than originally contemplated, according to sources within the company. Increased costs placed the airplane in an unfeasible price area—considering the reduced market potential and necessary breakeven point—all obstacles to quantity production.

Ironically, another important development that slimmed Cessna's market for the 620 has been the rapid acceptance of the light twin business plane—in which field its Model 310 is a strong contender. Business use of these new airplanes has markedly cut into the rate of growth of larger multi-engine types, industry observers note. Cessna spokesman confirmed that this was also a factor in reducing the 620's market potential.

Cessna indicates that these were the major reasons for dropping the 620 before it got into additional high expenditures needed for production—it categorically denies that any technical problems had developed.

Cancellation was the heaviest blow suffered by a business aircraft manufacturer in past several years. Immediate effect is layoff of some 300 personnel connected with the 620, although the company states that it is relocating some on other programs. Officials refused to disclose how much it had invested in the program. One prototype has been flying since the summer of 1956 and recently passed Phase I flight tests for CAA. A complete airframe, minus engines and equipment, was built for static testing. First production models of the nine- to eleven-passenger transport were scheduled to come off the lines of the new Wallace Plant in early 1958.

Cessna's board has voted the regular quarterly cash dividend of 35 cents payable Nov. 15 to stockholders of record on Nov. 5. Sales of $70 million in Fiscal 1957 exceeded previous year's $66 million, but increase was due mainly to increased military business. Earnings for Fiscal 1957 were $5.05 per share contrasted with $5.48 per share in 1956, reflecting lower profit margins from military business, also increased engineering costs. Recent payment ceilings imposed on contractors by the Air Force has required Cessna to secure additional financing. Company expects 1958 fiscal year military volume to equal year past if no schedules are changed. Total business in Fiscal 1958 is expected to pass $70 million, according to Cessna President Dwane L. Wallace.

Douglas Aircraft

Large development write-offs of the Douglas DC-8 jet transport program and the conservative policy of writing down inventories on initial DC-8s to the estimated recovery value continued to reduce Douglas Aircraft Co.'s net earnings for the first three quarters of Fiscal 1957, the company said.

Douglas reported net earnings of $26,030,472 on sales of $828,417,000. Current earnings were reduced to $24,710,406 or $6.67 per share by a re-

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negotiation refund for Fiscal 1953 of $1,320,000, paid during the first quarter. The refund has been appealed by Douglas.

Earnings figures compare with a net of $20,596,000, or $5.56 per share, on $711,286,000 sales of the same period in 1956.

Douglas does not expect that current military financing restrictions will curtail its production programs or result in insurmountable monetary problems. The company's backlog of $1,905,000,000 on Aug. 31 was evenly divided between military and commercial orders. Military contracts are well divided between the three armed services.

Bell Aircraft

Bell Aircraft Corp.'s sales and earnings dipped during the first three quarters, compared to the same period last year. Sales were $151,366,136 in comparison to $156,197,799 last year, and net income for the first three quarters was $3,089,271 compared to $4,489,053 for that period last year.

This year's earnings per share are $1.16; last year the first three quarters' earnings were $1.73 per share.

Chance Vought

Chance Vought Aircraft Inc's income for the first nine months was $3.37 per share, compared to $1.84 per share for the same period last year.

The company has a backlog of $414,000,000 in unfilled orders. Sales for the first three quarters this year totaled $145,474,079, compared to $77,147,535 last year.

Rohr Aircraft

Rohr Aircraft Corp. reported that sales of $115,765,922 for the first three quarters produced earnings of $3,727,000, or $4.14 per share. In the previous year comparable sales were $90,027,159 and earnings $3.49 per share. Backlog on July 31 was $251,000,000, half in commercial orders.

Republic Aviation

Usual figure for order backlog was eliminated from Republic Aviation Corp.'s third quarter financial report because of defense cutbacks and uncertainties in the F-105 program. Sales for the nine months ended Sept. 30 totaled $220,744,918, and net income was $4,890,418 or $3.32 a share. This compared with $232,370,178 and net income of $4,814,000 or $3.27 a share last year.

Martin Co.

Martin nine months sales totaled $308,186,621 compared with $228,766,424 last year. Net income of $6,503,049 compared with $7,311,022 last year and earnings per share were $2.22 compared with $2.58 last year.

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☐ **Call your local** Civil Defense Director. He'll help you set up a plan for your offices and plant—a plan that's safer, because it's entirely integrated with community Civil Defense action.

☐ **Check contents** and locations of first-aid kits. Be sure they're adequate and up to date. Here again, your CD Director can help—with advice on supplies needed for injuries due to blast, radiation, etc.

☐ **Encourage personnel** to attend Red Cross First Aid Training Courses.

☐ **Encourage your staff** and your community to have their homes prepared. Run ads in your plant paper, in local newspapers, over TV and radio, on bulletin boards. Your CD Director can show you ads that you can sponsor locally. Set the standard of preparedness in your plant city. There's no better way of building prestige and good employee relations—and no greater way of helping America.

Act now . . . check off these four simple points . . . before it's too late.

Transport Courses Listed By States

A partial list, by states, of air transportation and management courses offered primarily in schools of business administration has been compiled by the U. S. Department of Health, Education and Welfare.

It was compiled by means of a catalog search, using as a basis an Office of Education, Division of Higher Education 1950-51 survey, which produced as part of its resources, data on schools offering courses in these subjects. Dates for which current course offerings are listed follow the school name.

This is a listing of course offerings only, as it is taken from catalogs. It is not intended to be a census of courses in actual operation. Consequently, contact should be made with the institution to determine whether specific courses will be in operation this year.

ALABAMA

University of Alabama (1955-56), University
- Air Transportation
- Traffic Management

ARKANSAS

University of Arkansas (1957-58) Fayetteville
- Air Transportation

CALIFORNIA

University of California (1957-58), Berkeley
- Air Transportation

University of Southern California (1956-57), Los Angeles
- Air Transportation
- Fundamentals of Aviation
- Air Cargo Economics and Operation
- Airline Operation and Management
- Airline-Airport, Practicum
- Airways and Airports
- Air Law and Regulations
- Aircraft Accident Investigation
- Aviation in the Modern World
- Current Aviation Problems
- Seminar in Air and Surface Transportation

University of San Francisco (1956-57), San Francisco
- Airline Transportation

University of Santa Clara (1957-58), Santa Clara
- Principles of Transportation

COLORADO

University of Denver (1955-57), Denver
- Air Transportation
- Airport Operation and Management
- Airline Operation and Management
- Aviation Industry
- Air Cargo
- Flight Operations
- Airport Establishment
- Airport Revenue
- Airline Traffic Management
- Problems in Aviation

University of Colorado (1956-58), Boulder
- Air Transportation and Management

CONNECTICUT

University of Bridgeport (1957-59), Bridgeport
- Introduction to Transportation (including air)

FLORIDA

University of Miami (1957-58), Miami
- Meteorological Aspects of Aviation Administration
- Air Transportation
- Airline Operation

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Audio frequency circuits in the receiver permit oral monitoring of both AM and FM transmission. The receiver is supplied in a cabinet and the panel is a light blue smooth finish.

SPECIFICATIONS

Frequency range	54 to 240 megacycles
Sensitivity at input terminals as a voltmeter	1.0 microvolt
Maximum signal input direct to receiver	0.1 volt
Receiver input impedance	51 ohms
Intermediate frequency	21.4 megacycles
IF bandwidth	300 kilocycles
Output indicator	panel meter with logarithmic scale
Auxiliary outputs	a: Audio for headphones b: DC output to operate a 1-ma chart recorder

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Technical Aspects of Aviation
Civil Air Regulations
Air Cargo
Legal Aspects of Aviation
Airport Management

Florida State University (1957), Tallahassee
Transportation Operation—Water & Air

University of Florida (1957-58), Gainesville
Air Transportation

GEORGIA

University of Georgia (1957), Athens
Civil Air Regulations and Meteorology
Airport Management and Operation
Economics of Transportation

ILLINOIS

Northwestern University (1956-57), Evanston
Air Transportation
Principles of Transportation (includes domestic and international air transportation)

St. Louis University (1955-56), Parks College of Aeronautical Technology, East St. Louis
Economics of Air Transportation
Meteorology I & II
Airline Traffic
Communications Equipment I & II
Flight Control Theory
International Air Law
Airport Management I & II
Air Cargo
Air Transportation Laboratory

INDIANA

Purdue University (1956-57), Lafayette
Aeronautical Meteorology
Airline Management and Operation
Air Traffic and Cargo
Airport Operation and Control
Special Problems in Air Transportation

Indiana University (1957-58), Bloomington
Principles of Transportation
Principles of Air Transportation
Graduate Survey of Transportation
Special Studies in Transportation

IOWA

State University of Iowa (1957), Iowa City
Air Transportation

KANSAS

University of Wichita (1957), Wichita
Air Transportation

MARYLAND

University of Baltimore (1955-57), Baltimore
Airline Operations and Management

University of Maryland (1955-57), College Park
Transportation Administration
Airline and Airport Management
Traffic Management
Commercial Air Transportation
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Problems in Airport Management
Seminar in Air Transportation

MASSACHUSETTS

Boston University (1957), Boston
Air Transportation
Air Freight Traffic

Northeastern University (1957), Boston
Transportation Practices

MICHIGAN

Detroit Institute of Technology (1957-59), Detroit
Air Transportation

MINNESOTA

University of Minnesota (1954-56), Minneapolis
Transportation: Services and Charges I & II
Economics of Transportation
Motor and Air Transportation

NEBRASKA

University of Nebraska (1957-58), Lincoln
Air Transportation

NEW YORK

New York University (1957-58), New York
Air Transportation
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by
Roy E. Marquardt
President

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NUMERICAL CONTROL ENGINEERS

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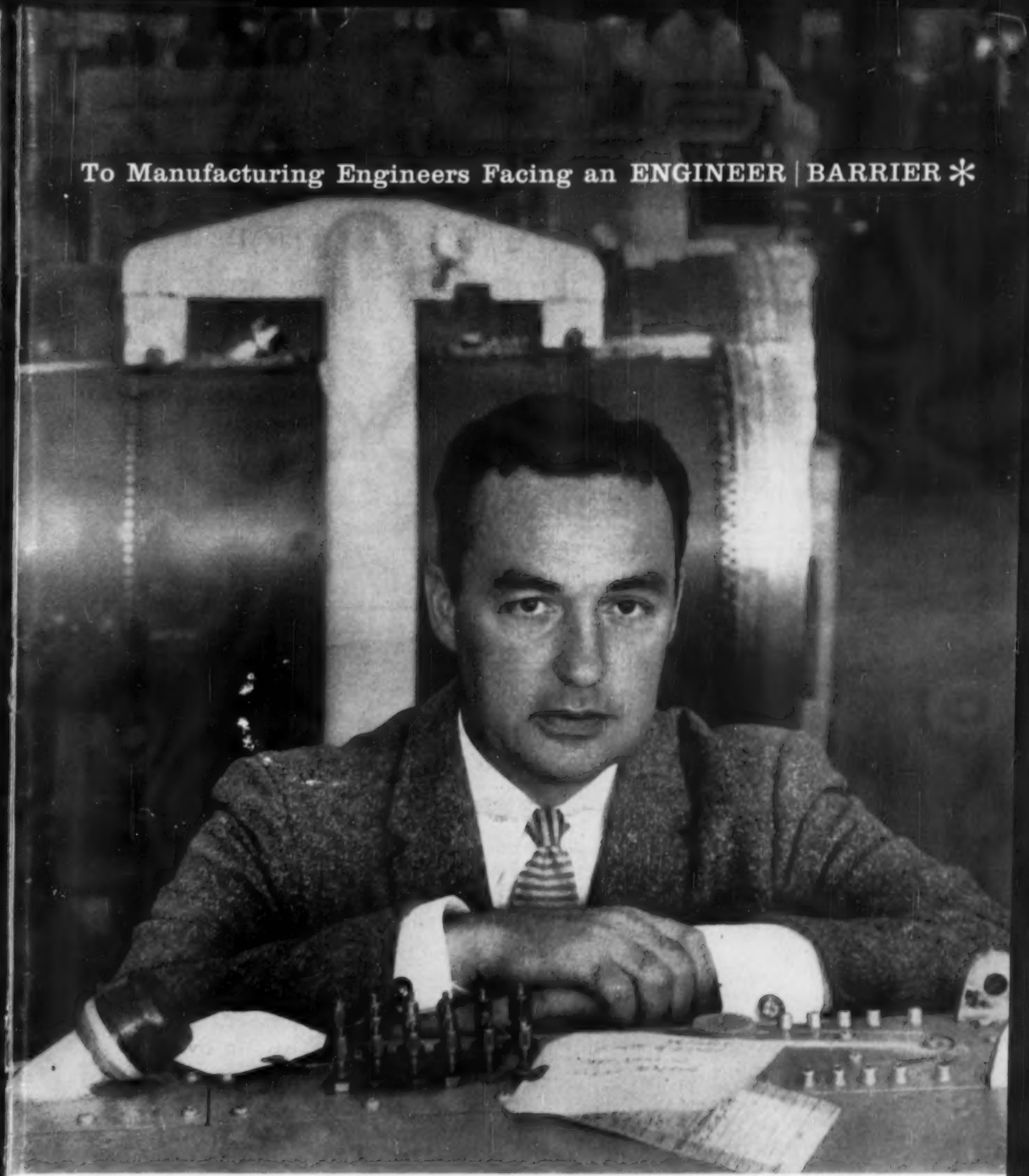

Shown here: John S. Liefeld, Director Van Nuys Manufacturing Division

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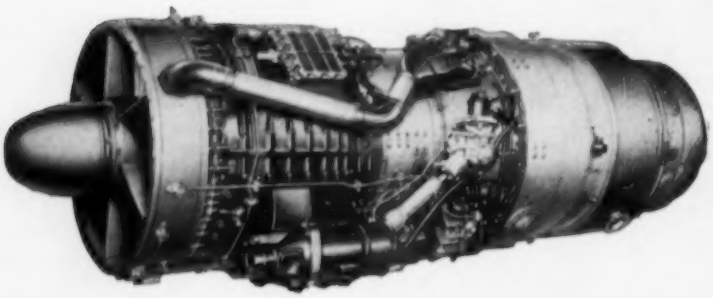

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Air Transportation

John Carroll University (1956-57), Cleveland
Air Transportation

Kent State University (1956-57), Kent
Air Transportation, Operation and Management
Individual Investigation in Air Transportation

Ohio State University (1957-58), Columbus
Transportation and Public Utility Finance
Industrial and Commercial Traffic Management
Air Transport Management
Air Transportation
Aircraft Operation, Air Traffic Rules, and Meteorology
Aeronautical Meteorology

University of Toledo (1956-58), Toledo
Air Transportation

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PENNSYLVANIA

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Highway and Air Transportation

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Airline and Airport Management
Economics of Air Transportation

TENNESSEE

University of Tennessee (1957-58), Knoxville
Air Transportation
Airline and Airport Administration
National Aviation Policy

TEXAS

University of Texas (1956-58), Austin
Principles of Transportation
Air Transportation

Southern Methodist University (1956-57), Dallas
Economics of Transportation
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Transportation Problems and Policies

University of Houston (1957-58), Houston
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Canadian Air Terminal Development

Terminal building at Montreal's Dorval Airport (top) will be completed next year, but installation of electronic, other equipment, will delay operational use until early 1959. Terminal includes facilities for health, immigration and customs inspection, one waiting room for incoming passengers and one for the public. Bottom photo is of recently completed terminal building at Quebec City Airport.

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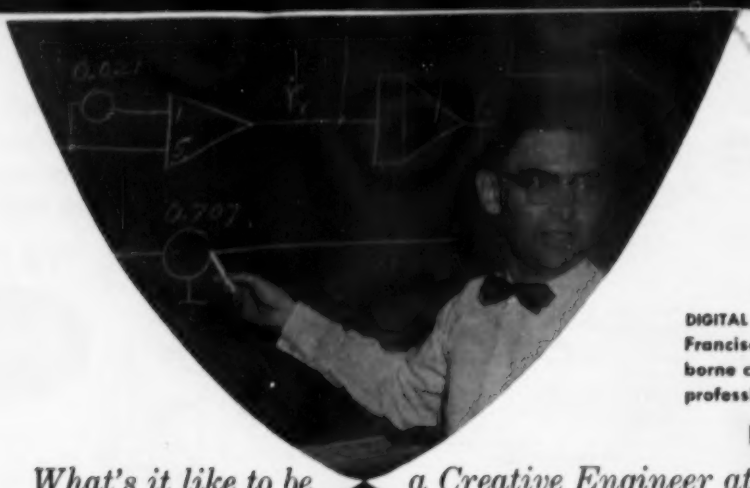
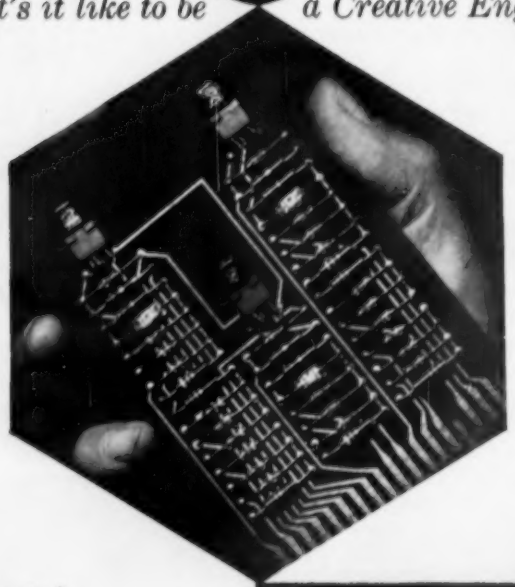


DIGITAL COMPUTER SYSTEMS ENGINEER Sherman Francisco tells why simulation studies of airborne computers offer a singularly challenging professional experience.

What's it like to be a Creative Engineer at IBM



'Airborne computers present a special challenge to the creative engineer, because their systems must be planned and designed with flight situations in mind. Through simulation studies, we test computer systems right in our own labs—simulating both the dynamics of the aircraft and the environmental conditions encountered. My biggest thrill? To see my first simulated bombing mission!"

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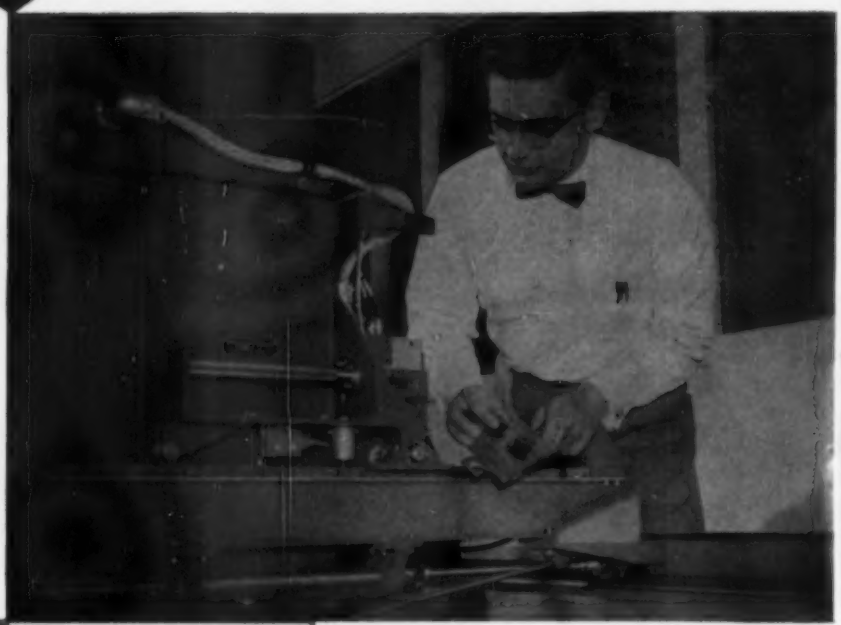

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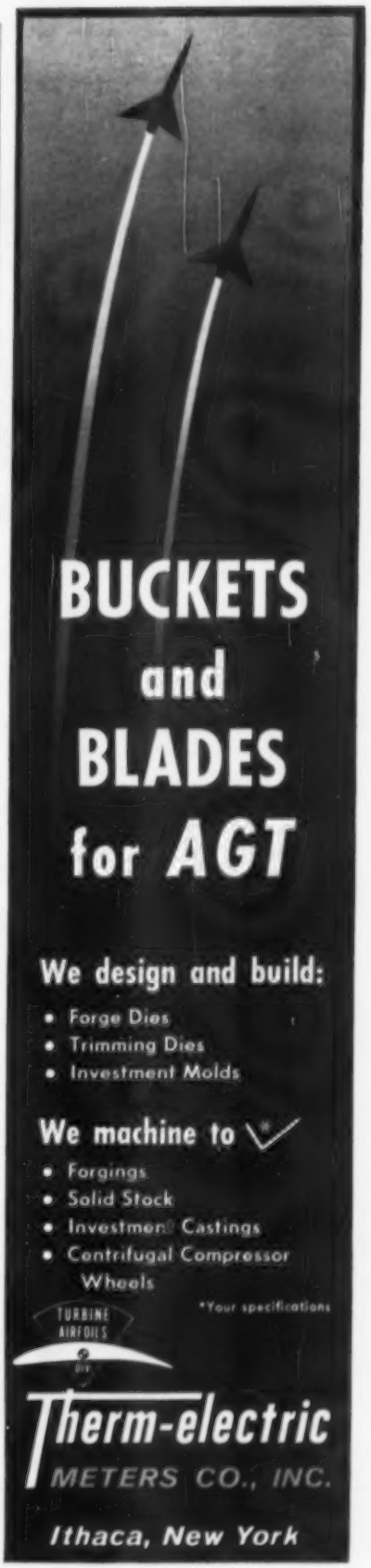


LETTERS

Reaction to Editorial On Missile Radar

Once again I am prompted to congratulate you on your bold, forthright and constructive editorials in connection with our failure to lead the world in scientific endeavor and military strength.

Please keep up the good work, and don't spare the ammunition.

ALEXANDER P. DE SEVERSKY
New York, N. Y.

Your editorial, "Why, Mr. President?" was excellent.

GERHARD NEUMANN
General Manager
Jet Engine Department
Aircraft Gas Turbine Division
General Electric Company
Cincinnati, Ohio

I could not be more in accord with an editorial than I am with "Why Mr. President?"

It is about time that someone asked these questions. One more question should be asked, I believe. How can an administration, which is belaboring our needs for more and more scientists and engineers with one voice, so vehemently destroy the desire for military applications in the engineering population with another. I have a young son who may some day be interested in a scientific education at M.I.T. or Harvard. What can I, an engineer father, say about the stability, opportunity and prestige of the field?

Probably, that it's fine if one stays clear of military contracts and works in a completely commercial market. What kind of confidence is this in our government and society?

The problem is that one or two voices crying alone are not enough. I can only hope that magazines like AVIATION WEEK and editorials like yours can awaken the entire, rather than only the engineering, population.

HAROLD A. KEIT
Arlington, Mass.

I must say Mr. Robert Hotz's editorial published in AVIATION WEEK on Oct. 21, entitled "Why Mr. President?", is one of the best in many of the excellent articles written in the past few months. I am so surprised on the quality of his articles that I sometimes wonder whether Robert Hotz has a number of ghost writers. He made a few comments about security which are very interesting. I want to say that in my 17 years of service I question whether anyone could be more security minded than I am.

It reminds me of the time when I was stationed overseas and a reporter asked me a few questions about our squadron operations; I completely refused to talk to him since even though I was only a second lieutenant I knew I was not a public information officer. I refused to have anything to do with him except telling him my "name, rank, and serial number," as the classical phase goes. To this day I try to maintain the same type of security. My only point is that I consider AVIATION WEEK my best source of information on the state of art of development in the aviation field, the best source of security leaks, and, without question, the best test of the military effectiveness of maintaining security information from the enemy.

As AVIATION WEEK stated numerous times, it publishes information already well known by the local public, whether it be Patrick Air Force Base, Edwards, WADC, or any one of the other centers on major industrial areas. If the local populace knows about it, I am forced to assume that the enemy also has no trouble to obtain such information. This may not appear logical, but if one is to be security conscious, let us not blame reporters for publishing what is already well known to the local public.

If a breach of security has been violated, let us find the source.

My basic point is this: congratulations to AVIATION WEEK for the fine articles published and for showing us the weakness in some of our security measures and, to some extent, some of our misgivings. Please mind you, I am not for extreme security measures. That is the reason for our public information officers. They should always release information that they are sure is already in enemy hands since that is the only way for rapid release of educational technical information to our college students, graduates, and industry in general. They can only avail themselves of new developments through unclassified information.

We must push forward.

With all apologies to Mr. Wilson, I, for one, feel it is necessary to know why potatoes turn brown when fried (I am sure I already know), but also I, as an engineer, whether it be in the Army, Navy, Air Force or private industry, do want to probe the unknown. To steal General Electric's slogan, I want to conclude that "progress must be my product," and I am sure it is also the Air Force's objective.

LEON S. JABLECKI
Tullahoma, Tenn.

(Mr. Hotz writes his own editorials.—Ed.)

Congratulations on your courage and devotion to duty in printing the story of U.S. observations, by radar, of the Soviet missile program (AW Oct. 21, p. 26).

Your editorial rates equal praise, as does your consistent program against the idiotic quote security unquote regulations we have had to bear.

As a long-time and enthusiastic subscriber to Aviation Week, I have again seen dramatic demonstration that your magazine stands alone among "trade papers," and in my experience rates well ahead of most national news magazines in accuracy, timeliness (no pun) and depth of coverage.

When the brickbats begin to fly, if they haven't already, take comfort. I feel certain that a great majority of your readership feels as I do. Again—congratulations!

ROBERT BLODGET
Westport, Conn.

Why not send a free subscription of AVIATION WEEK to the President, the White House, 1600 Penasylvania Avenue, Washington, D. C.?

Maybe he would read your editorials on his way to the golf course, and maybe we might then have a genuine missile program.

MALCOLM H. DUBIN
Former Air Force Officer
Louisville, Ky.

Your editorial appearing in the current edition of AVIATION WEEK ("Why, Mr. President?", Oct. 21) was picked up by the Beacon's editorial page editor, Mark Clutter.

The piece received some mighty lofty comment in this area. Keep up the good work.

GIL RECTOR
Aviation Editor
The Wichita Beacon
Wichita, Kan.

Editorial Appreciation

I want to thank you for your very complimentary editorial in the Oct. 7 AVIATION WEEK.

All of us in TWA appreciated your accurate and friendly approach.

It was a real pleasure to read it and you can bet my head swelled with genuine pride.

I have had copies sent to all of our stations so that each employee will have a chance to read your good words.

Thanks again for this fine job of journalism and reporting.

CARTER L. BURGESS
President
Trans World Airlines, Inc.
New York, N. Y.

First Viscount Buyer

In AVIATION WEEK on Sept. 9 p. 47) you referred to Hunting Clan Air Transport having to buy two Viscounts to replace Vikings on its Safari routes to East and Central Africa. In fact, Hunting Clan brought their first three Viscounts over two years ago and were the first independent operator in the world to do so.

DAVID BETT
Hunting Group
Park Lane, London, W1
England

Aviation Week welcomes the opinion of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42 st., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

How you can save time and money with

Harvey Aluminum Impact Extrusions

Many engineers and designers are overlooking the exclusive advantages of aluminum impact extrusions. This advanced metalworking operation offers design flexibility; versatility of alloys; draft free, close tolerance parts requiring minimum machining; smooth surfaces; and significant **savings in man hours,** machining, and material.

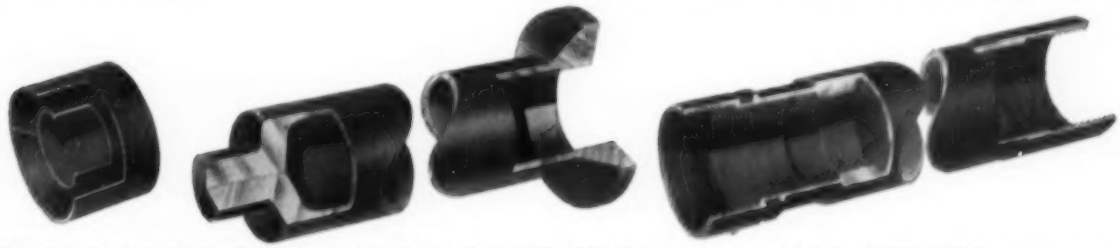
Custom configuration with precision tolerances

Typical applications of Harvey Impact Extrusions are illustrated below. Harvey Impacts have a smooth surface and require no machine finishing for most ordnance, airframe, and missile applications. Harvey's integrated services provide an economical, quality product that meets all specifications of high strength, light weight, resistance to corrosion and heat, critical tolerances in wall thickness, maximum heat conductivity, and low unit cost.

Harvey Aluminum leads in impact extrusions

Harvey pioneered in the impact extruding of intricate configurations. This experienced leadership, plus technical know-how and the most advanced facilities, are available for your own specialized design requirements. The integrated Harvey engineering team of research, design, metallurgy, and quality control will expedite your product from drawing board to finished product quickly, efficiently, economically.

If you have a design that calls for hollow, closed end sections... high strength... zero-degree walls and surfaces... unusual length to diameter ratios, integral ribs, fins, and bosses... close tolerances... with volume production, low unit cost... *your Harvey Field Engineer will be happy to show you how Harvey Impact Extrusions can help solve your design problems.*



ROCKET FIN with integral guiding vanes impacted as a one-piece unit from alloy 7075-T6. This impact extrusion provides transverse physical properties equal to longitudinal properties and a high degree of dimensional accuracy with close tolerances. Similar symmetrical designs in diameters up to 10 inches can be impact extruded.

LANDING GEAR COMPONENT provides highest physical properties, greatly reducing material and machining costs. The impact, obtainable in various lengths, is made from aluminum alloys which assure optimum internal grain structure. This impacted piston replaces costly method of hogging out bar stock or machining a forging. Diameters of barrel are held to close tolerance dimensions with superior surface finish.

ROCKET MOTOR TUBE with integral formed bulkhead for application in rockets. Length to 8 feet, diameter 6-8". Tube has a thicker cross-section at both ends to accommodate threading. This type of Harvey Impact Extrusion in high strength aluminum alloys offers high transverse properties for added hoop strength.

Making the most of aluminum... for everyone

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HARVEY ALUMINUM SALES INC., TORRANCE, CALIFORNIA

Branch offices in principal cities

Harvey is a leading independent producer of quality aluminum products in all alloys and sizes: Rod and bar, pipe, tube, hollow sections, press forgings, forging stock, impact extrusions, structurals, special shapes, extrusions, screw machine products and other aluminum products. Harvey is also producing similar items in titanium and steel.

E B POWER
UNIVERSITY MICRO
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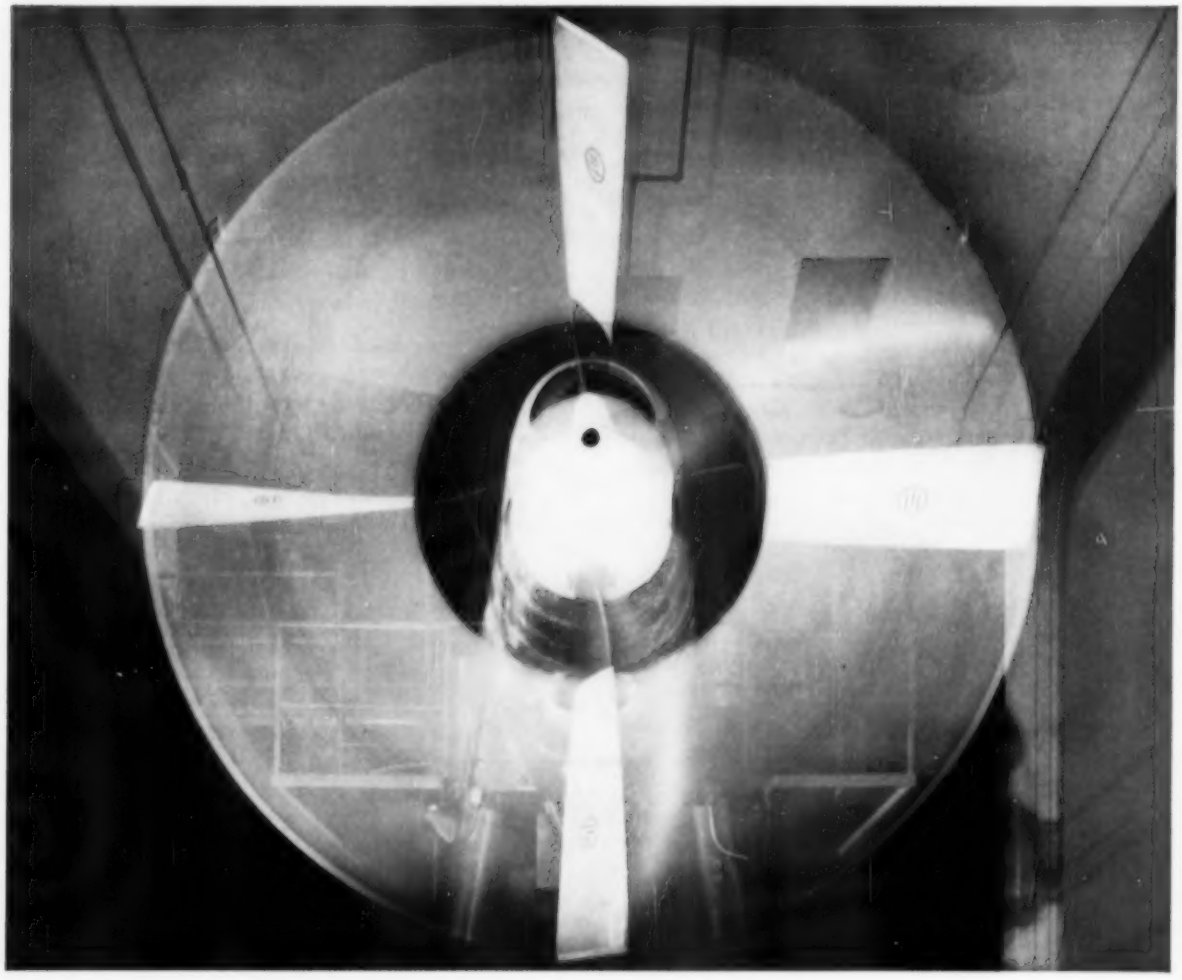
d General Motors Power Team
rop-Jet Engines
and Aeroproducts Turbo-Propellers Marks Another Milestone by Receiving CAA Approval for Commercial Operation



CAA AFFIRMS DEPENDABILITY OF ALLISON PROP-JET POWER. Another major step toward commercial airline operation of Allison Prop-Jet power in the Lockheed Electra has been accomplished with the on-schedule approval of the Allison Model 501-D13 Prop-Jet engine and Aeroproducts 606 Turbo-Propeller by the Civil Aeronautics Administration. Backing up the qualification test were 80,000 hours of development time on test stands, over 75,000 hours of experimental and service flight time and testing of engine components for an additional 50,000 hours. Approval of the CAA brings one step closer airline operation of this matched General Motors power team for the jet age in air transportation.

ALLISON DIVISION OF GENERAL MOTORS, Indianapolis, Indiana

ALLISON PROP-JET POWER